MADGETECH
WE BUILD DATA LOGGERS

Data Logger and Software Operating Manual

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Revised 06/22/09

Introduction

Small, simple and affordable, MadgeTech data loggers can measure and record data at specified intervals. MadgeTech's Data Recording Software requires no programming skills, and enables the user to effortlessly select reading rate, specify the user's ID, and initiate the start of data collection. For immediate use of the data logger refer to the Quick Start Guide on page 14.

In addition, all data can be saved in a format easily read by spreadsheet applications such as "Microsoft Excel®" or "Lotus 1-2-3®". It is our goal to bring you accurate, low-cost, easy-to-use data loggers that integrate easily into the user's working environment. To better understand your needs and to better serve you, we welcome and appreciate your feedback.

Thank you for choosing MadgeTech for your data logging requirements.

Warranty

Products manufactured by MadgeTech, Inc., are warranted against defective material and workmanship for a period of one year, starting from the date of shipment. In the event that a MadgeTech product is found to be defective, MadgeTech will repair or replace the product at its sole discretion. Such repair or replacement shall be the sole remedy of this warranty.

This warranty extends only to the original purchasing customer and does not apply to any unit, which in our sole judgment, has been subjected to:

a) Operating or environmental conditions in excess of our written specifications or recommendations;

b) Customer damage, misuse or neglect;

c) Improper installation, repair or alteration.

This warranty excludes batteries.

Except as to title, this is our only warranty for the products. MadgeTech, Inc. expressly disclaims all other warranties, guarantees or remedies—whether expressed or implied or statutory—including any implied warranty of merchantability or fitness for a particular purpose. We also disclaim any implied warranty arising out of trade usage or out of a course dealing or course of performance. We do not guarantee the integrity of data or warranty that the products will operate uninterrupted or error-free.

MadgeTech data loggers and their associated software have been thoroughly tested and the documentation reviewed. However, MadgeTech does not warrant the performance of its products, or that the products or their associated software will operate as described in this manual.

Please see page 145 for a more descriptive explanation of our warranty.

Battery Warning

Most MadgeTech data loggers contain a lithium battery. Do not cut the battery open, incinerate, or recharge. Do not heat lithium batteries above the specified operating temperature.* Dispose of the battery in accordance with local regulations.

*See the individual specification sheets at www.madgetech.com.

Battery Replacement

Most MadgeTech miniature data loggers contain a user-replaceable 3.6 volt or 3.0 volt lithium battery. Replacement batteries may be purchased from the factory along with installation instructions. Before attempting to replace a battery, refer to published specification sheets at http://www.madgetech.com select (1) Products. Then click the link for the specific data logger to ensure the device has a user-replaceable battery. If the device does not have a user-replaceable battery, or the customer simply does not wish to replace the battery themselves, the device may be returned to the factory for service. In this case, the customer should contact the company from which the unit was purchased for an Return Merchandise Authorization (RMA) number and return the product as instructed by customer service. MadgeTech will replace the battery and return the data logger promptly.

Hardware

Package Inspection

Verify that the data logger(s) was not damaged in transit by carefully unpacking all items in the shipping carton and looking for obvious signs of physical damage. If the data logger is damaged, repack it in its original container and contact MadgeTech Customer Service at 603-456-2011. Any damage noted upon receipt must be documented to file a claim against the carrier.

System Requirements

MadgeTech Data Recording software requires an IBM or compatible PC with the following:

- •- Pentium or higher processor
- Windows 95/98/2000/XP/NT/VISTA
- 128 MB RAM
- Color 800 X 600 monitor
- 30 MB free disk space
- 3.5" disk drive or CD-ROM
- Available 9 pin male serial (COM) port or USB port

NOTE: Although the software is designed to work with the Windows operating systems listed above, MadgeTech cannot guarantee operation on OS's no longer supported by Microsoft Support Life Cycle Policy.

Software Installation

Installing from CD ROM

Insert the CD ROM labeled MadgeTech Data Recording Software into the host computer's CD ROM drive. If the CD does not run automatically, from the Windows Start Menu, choose the Run command and type d:\autorun.exe into the **Open field and click OK**, it will bring the installation menu window **MadgeTech CD Contents** as shown below.

If the host computer's CD ROM Drive is not the D: drive, use the correct letter for the instructions above.

MadgeTech
MadgeTech CD Contents
MadgeTech Software
Install software for use with MadgeTech data loggers
Drivers and Third Party Tools
Install drivers and software for use with USB interface cables and accessories
View Documentation and Resources
View MadgeTech documentation
View CD Contents
Exit CD Browser
MADGETECH
WE BUILD DATA LOGGERS

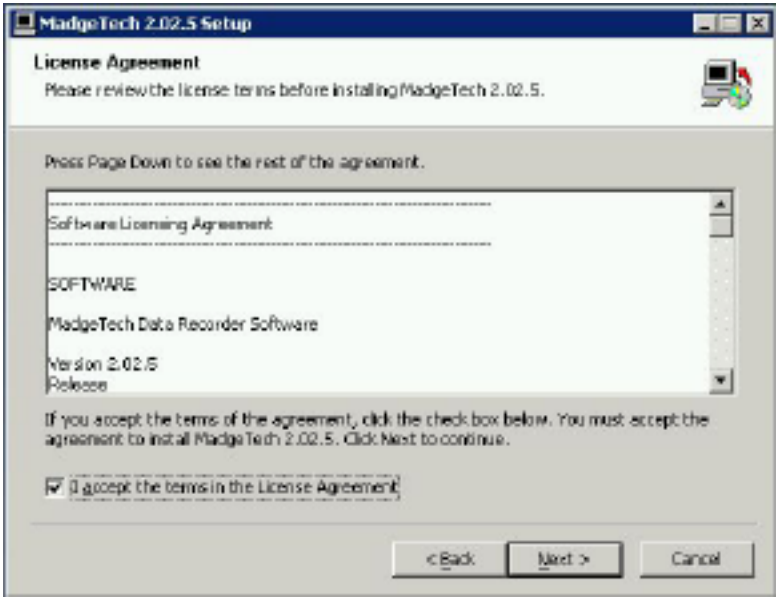
Click MadgeTech Software to Install Madgetech Software Page.

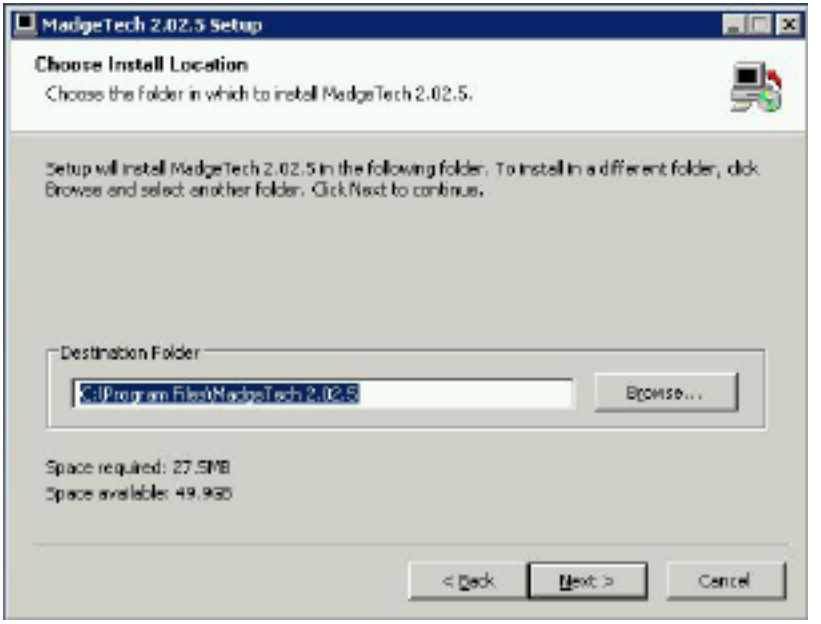
Install MadgeTech Software

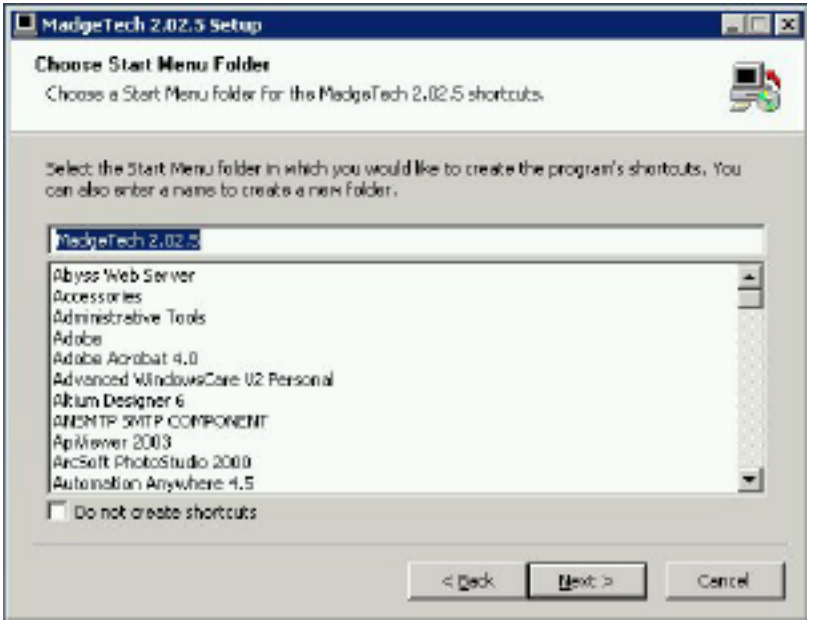
The selected language will be displayed on the installation windows.

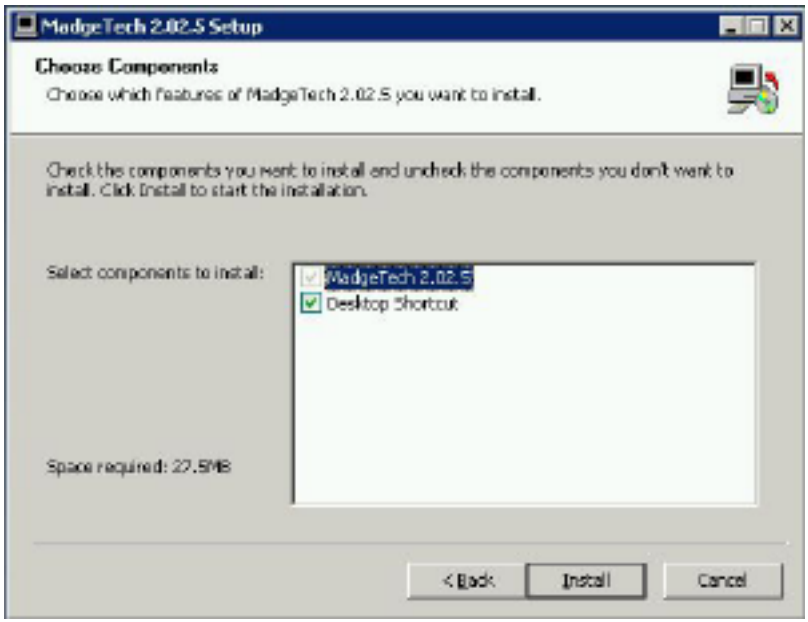
The following screens (could possibly show a previous version number) are examples of the installation windows.

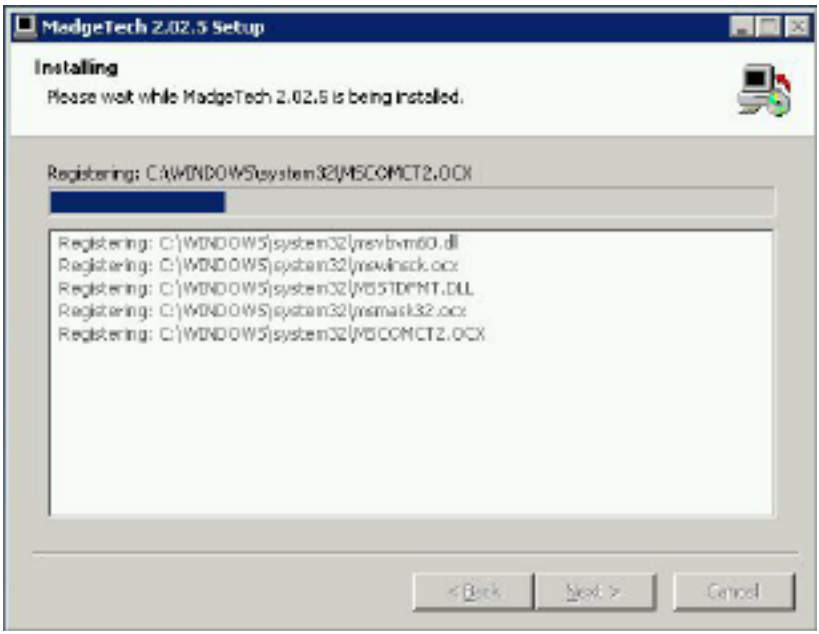
MadgeTech 2.02.5 Setup
Welcome to the MadgeTech 2.02.5 Setup Wizard
This wizard will guide you through the installation of MadgeTech 2.02.5.
It is recommended that you close all other applications before starting Setup. This will make it possible to update relevant system files without having to reboot your computer.
Click Next to continue.
Next >
Cancel


MadgeTech 2.02.5 Setup
License Agreement
Please review the license terms before installing MadgeTech 2.02.5.
Press Page Down to see the rest of the agreement.
Software Licensing Agreement
SOFTWARE
MadgeTech Data Recorder Software
Version 2.02.5
Release
If you accept the terms of the agreement, click the check box below. You must accept the agreement to install MadgeTech 2.02.5. Click Next to continue.
I accept the terms in the License Agreement
< Back
Next >
Cancel


MadgeTech 2.02.5 Setup
Choose Install Location
Choose the folder in which to install MadgeTech 2.02.5.
Setup will install MadgeTech 2.02.5 in the following folder. To install in a different folder, click Browse and select another folder. Click Next to continue.
Destination Folder
C:\Program Files\MadgeTech 2.02.5
Browse...
Space required: 27.5MB
Space available: 49.9GB
< Back
Next >
Cancel


MadgeTech 2.02.5 Setup
Choose Start Menu Folder
Choose a Start Menu folder for the MadgeTech 2.02.5 shortcuts.
Select the Start Menu folder in which you would like to create the program's shortcuts. You can also enter a name to create a new folder.
MadgeTech 2.02.5
Abyss Web Server
Accessories
Administrative Tools
Adobe
Adobe Acrobat 4.0
Advanced WindowsCare V2 Personal
Altium Designer 6
ANSNTP SMTP COMPONENT
ApiViewer 2003
ArcSoft PhotoStudio 2000
Automation Anywhere 4.5
Do not create shortcuts
< Back
Next >
Cancel


MadgeTech 2.02.5 Setup
Choose Components
Choose which features of MadgeTech 2.02.5 you want to install.
Check the components you want to install and uncheck the components you don't want to install. Click Install to start the installation.
Select components to install:
MadgeTech 2.02.5
Desktop Shortcut
Space required: 27.5MB
< Back
Install
Cancel


MadgeTech 2.02.5 Setup
Installing
Please wait while MadgeTech 2.02.5 is being installed.
Registering: C:\WINDOWS\system32\MSCOMCT2.OCX
Registering: C:\WINDOWS\system32\msrbvm60.dll
Registering: C:\WINDOWS\system32\mswinsck.ocx
Registering: C:\WINDOWS\system32\MSSTDFMT.DLL
Registering: C:\WINDOWS\system32\msmask32.ocx
Registering: C:\WINDOWS\system32\MSCOMCT2.OCX
< Back
Next >
Cancel

"Click Back to MadgeTech CD Contents to MadgeTech CD Contents page. Click MadgeTech Pocket to Install MadgeTech Pocket Software page:

MadgeTech
Install MadgeTech Pocket Software
Install ActiveSync
Installs Windows Pocket PC interface (required for MadgeTech Pocket)
Install .Net Compact Framework 3.5
Installs .Net Compact Framework 3.5 for MadgeTech Pocket support
Install MadgeTech Pocket
Installs MadgeTech Pocket datalogger relay software
Back to MadgeTech CD Contents
View CD Contents
Exit CD Browser
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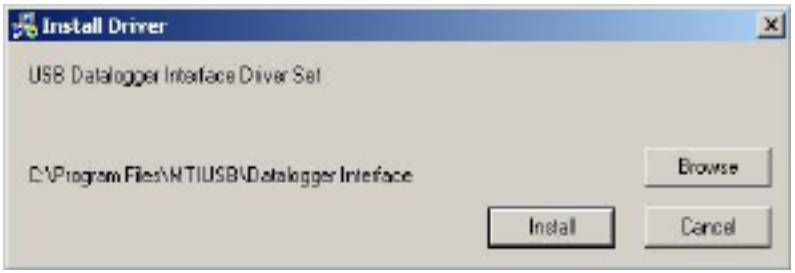
Click Back to MadgeTech CD Contents to MadgeTech CD Contents page. Click Drivers and Third Party Tools to MadgeTech Device Drivers and Third Party Tools page:

MadgeTech
MadgeTech Device Drivers and Third Party Tools
Install USB Interface Drivers
Installs Windows device drivers for the MadgeTech USB interface cable
Install Tibbo Software (Ethernet Device Server)
Installs Tibbo software for DS202 serial device server
Back to MadgeTech CD Contents
View CD Contents
Exit CD Browser
MADGETECH
WE BUILD DATA LOGGERS

Install USB Interface Drivers (for use with IFC200)
The USB interface drivers can be installed when the host computer has USB drivers. After the installation the data logger will communicate with the PC through USB port. The host computer must have USB drivers to install the USB interface drivers.

Select the **Install** button to install USB interface drivers.



Note: A pop up box may appear stating, "This software may impair or destabilize the operation of your system, either immediately or in the future." Do not worry about this message. The drivers have been tested and will not interfere with the operation of the host computer. Select "continue" to proceed with the installation.

Click **Back to MadgeTech CD Contents** to **MadgeTech CD Contents** page. Click **View Documentation and Resources** to **Documentation and Resources** page:

MadgeTech
Documentation and Resources
View MadgeTech Software ReadMe
View important information about the MadgeTech Software
View MadgeTech Software Manual
View the MadgeTech Software user's manual
*Requires Adobe Acrobat Reader
View MadgeTech Software Quick Start Guide
View the Quick Start Guide for the MadgeTech line of data loggers
*Requires Adobe Acrobat Reader
Back to MadgeTech CD Contents
View CD Contents
Exit CD Browser
MADGETECH
WE BUILD DATA LOGGERS

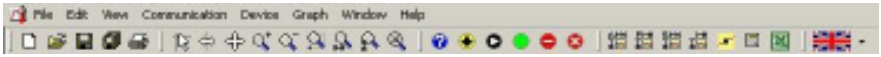
View MadgeTech Read Me, **View MadgeTech Software Manual** and **View MadgeTech Quick Start Guide** are documents about MadgeTech data loggers, software, and more. After installation, the software will be listed under the default MadgeTech software program group and saved under the default C:\Program Files\MadgeTech 2.00.XX\directory.

Running the Software

Getting Started

For simplicity and ease of use all MadgeTech data loggers operate similarly. The MadgeTech data logger software automatically configures itself specifically for each class of logger by reading the device type. Each class of logger has a unique device type and identifies itself when queried by the host computer. This has been implemented to minimize confusion and to eliminate the need to learn different software packages. Therefore, only one software package and only one manual is required for all MadgeTech Data Loggers. In certain instances where differences occur, an attempt is made in this manual to bring clarification and avoid confusion. Most examples used in this manual are for the Temp101, but can be extended to all devices.

Run the software by selecting the MadgeTech icon in the MadgeTech Software program group. The software will open and is immediately ready for starting a device or downloading data. The tool bar and menu items will appear as shown below. All toolbar commands are also menu commands.



Note: Throughout this manual, when a menu command has a corresponding toolbar command, the toolbar icon is included with the description of the menu command.

Quick Start Guide

For immediate use of the data logger, follow these six simple steps:

1. Install the software (see Software Installation page 5, if help is needed with this step).

Attach the logger:

1a. If using the IFC110, attach the logger to the host computer using the interface cable, as shown in the diagram on the next page.

1b. If using the IFC200 or IFC300, install the USB drivers first, then attach the logger to the host computer using the interface cable, as shown in the diagram on the next page.

2. From the Communication Menu, select **Auto Configure Port**.
3. From the **Device Menu**, select **Start Device**.
4. Select the **Reading Rate** to be used. Leave all other settings alone.
5. Click on **Start Device**.

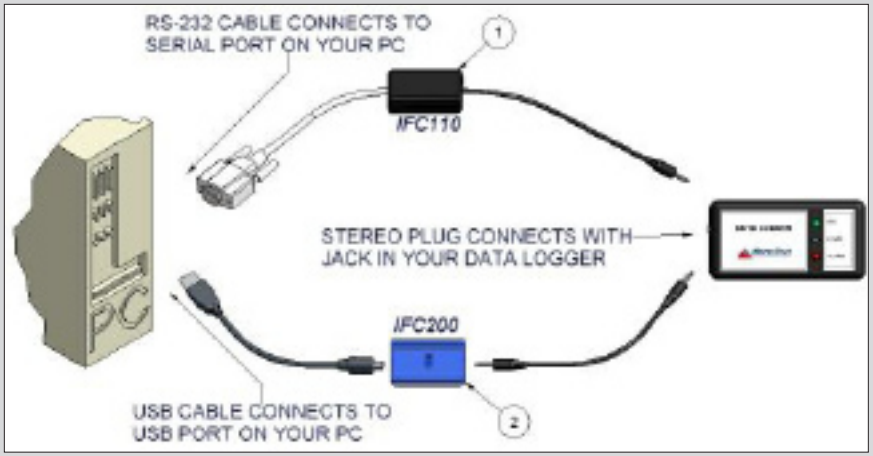
After a brief pause while the software communicates with the device, the user will see the message **Device Started**. The device is now running and taking measurements. Place it in the elected environment to perform its measurements. When the user is ready to view the measurements, simply connect it to the computer and select **Read Device Data** from the Device Menu.

For data loggers featuring a delay start, see page 68.

Attaching the Interface Cable

IFC110 Interface Cable for serial port (same concept for IFC102, IFC 103, IFC200, IFC202, and IFC300).

Interface Cable Installation

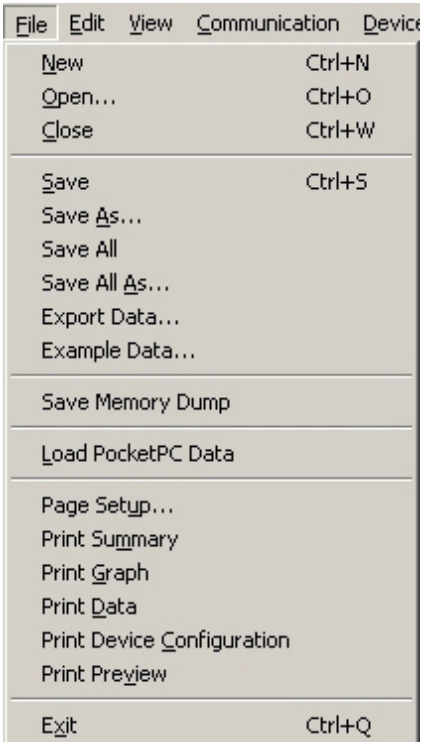


1. Fully insert the male connector of the IFC110 interface cable into the female receptacle of the data logger. Insert fully the RS232 connector into the Serial Port.
2. Fully insert the male connector of the IFC200 interface cable into the female receptacle of the data logger. Fully insert the female USB connector into the USB.

Note: Most MadgeTech data loggers can use both IFC110 and IFC200 interface cables. For interface cable data logger clarification contact technical support at 603-456-2011 or support@madgetech.com.

File Menu

The **File Menu** will appear as follows:



File Menu: New

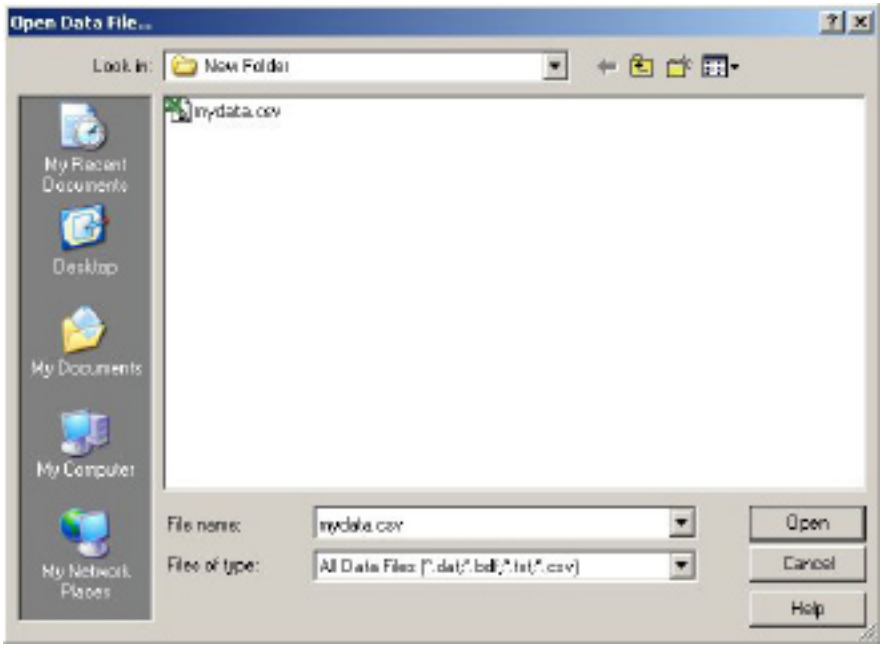
Select this command to create a new graph window. It will not discard any information that is already on the screen or in existing windows. Multiple windows may be created and displayed simultaneously, and may be manipulated using the **Window Menu**, page 106.

File Menu: Open

Select this command to open previously saved data files, loading them into the current window. If no windows are open, a new one will be created. Data in the current window is not discarded, new data is added as an additional dataset. Multiple windows may be created and displayed simultaneously, and manipulated using the **Window Menu**, page 106.

Open Dialog Box

Select the **Open** command for the following window:



There are three types of files that may be opened with this software. These file formats are described in **Save All** (next page).

File Menu: Close

This command closes the currently active window. If the data displayed in the window has not been saved, the user will be prompted to save it at this time. This command will not discard data from or close any other existing windows.

File Menu: Save

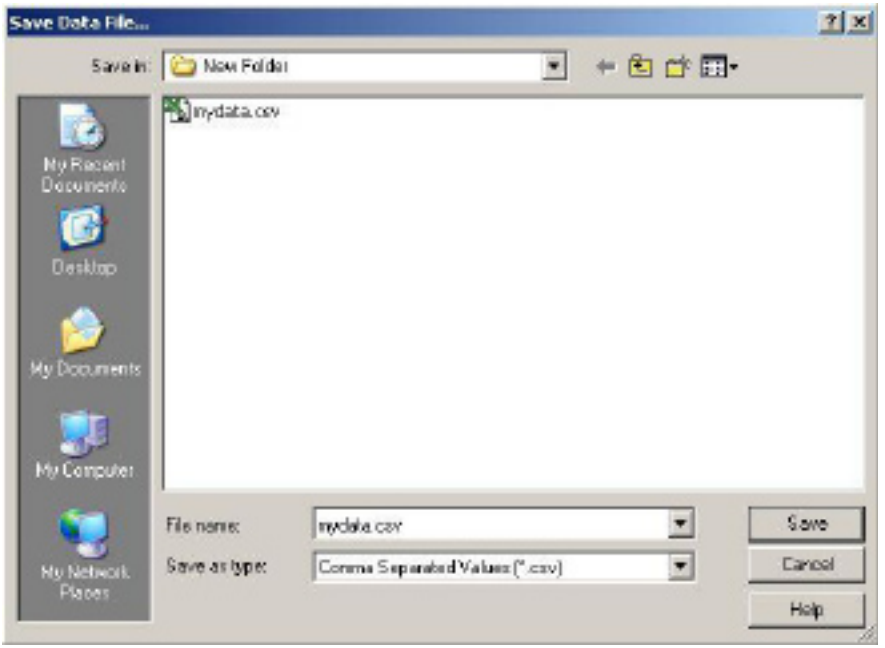
Saves the dataset currently being shown.

File Menu: Save As

Select **Save As** from the **File Menu** to save a copy of data under an alternate name, in any of the three file types discussed on the following page.

File Menu: Save All

Select **Save** or **Save All** from the **File Menu** to display the window as shown below:



Data may be saved as one of three types of files. These files are as follows:

***.dat**

This is our own internal ASCII data format. This format can be viewed by most text editing or word processing software.

***.txt**

Files stored in this format contain tab delimited text and can be viewed by most word processing and spreadsheet programs.

***.csv**

Files stored in this format contain comma separated values and are directly readable by Microsoft Excel® and other spreadsheet programs.

Note: In order to save a dataset, it must be displayed in the graph or data tab.
Note: To read data in an external program use the Export Data commands.

File Menu: Save All As

Select **Save All As** from the **File Menu** to save all copies of datasets under alternate names, in any of the three file types discussed.

Note: The user will be prompted to save each individual dataset as a different file. The software does not open/save multiple datasets in a single file; they are required to be uploaded individually.

File Menu: Export Data

Select **Export Data** from the **File Menu** to export a copy of the data in a format that is designed for easy import into programs such as Excel®. Data can be read in the same units displayed on the screen. The three file types are the same as those provided with the **Save** command, except data which is specific to the software, such as graph colors, is stripped out. Use Export to open the file in another program.

File Menu: Example Data

Select the **Example Data** command from the **File Menu** to load and display sample data. Example data can be given for Temperature, Humidity, Pressure, Voltage, Current, Shock, Level, pH, Bridge, and Wireless Series Data Recorders. Simply enter in the part number of a data logger and click **O.K.**

File Menu: Save Memory Dump

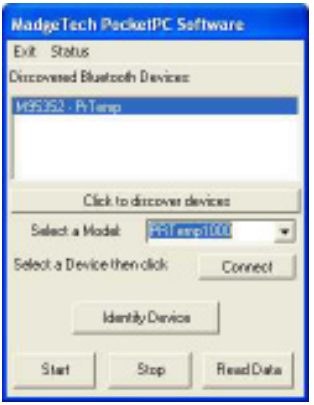
Select **Save Memory Dump** from the **File Menu** to download the entire memory contents of the attached device and save it in binary format. This command is useful to the factory for troubleshooting problems in the field and recovering data from a malfunctioning device. The user will typically not use this command unless directed to do so by our tech support department.

File Menu: Page Setup

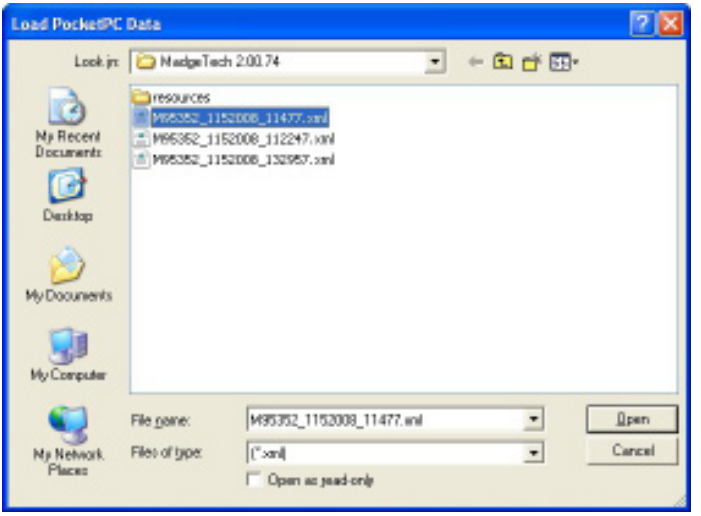
Select **Page Setup** from the **File Menu** to bring up the window on the next page. This window allows the user to select the printer and printing options. The options will vary according to the particular printer and network. Consult the printer manufacturer for details about the printer's options.

File Menu: Load PocketPC Data

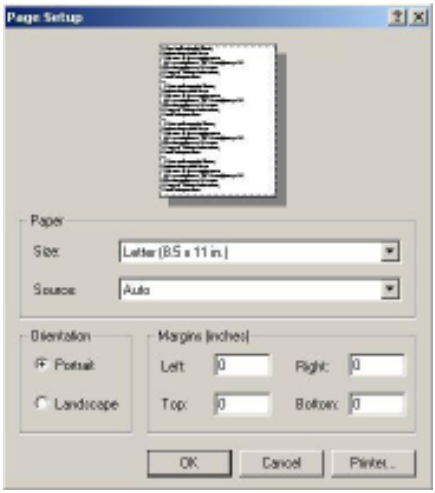
Select **Load PocketPC Data** from the **File Menu** to load the data saved by MadgeTech PocketPC Software running on Windows Mobile Pocket PC devices.



A file selection dialog will appear and display the available XML files for selection. Data files saved by MadgeTech PocketPC Software are named with the data logger's serial numer and data collection date and time string and are in the XML file format.



Select the file to load and click **Open**.



File Menu: Print Summary

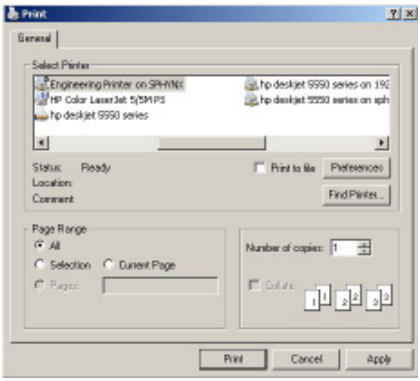
Select **Print Summary** from the **File Menu** to print the statistics for currently selected device.

File Menu: Print Graph

Select **Print Graph** from the **File Menu** to print the currently selected graph to the host printer. The single dataset file can be printed by viewing the Graph tab. Printing out the composite graph can be achieved through the Composite Graph tab.

Print Dialog Box

Select **Print Summary** or **Print Graph** from the **File Menu** to bring up the Print Dialog Box:

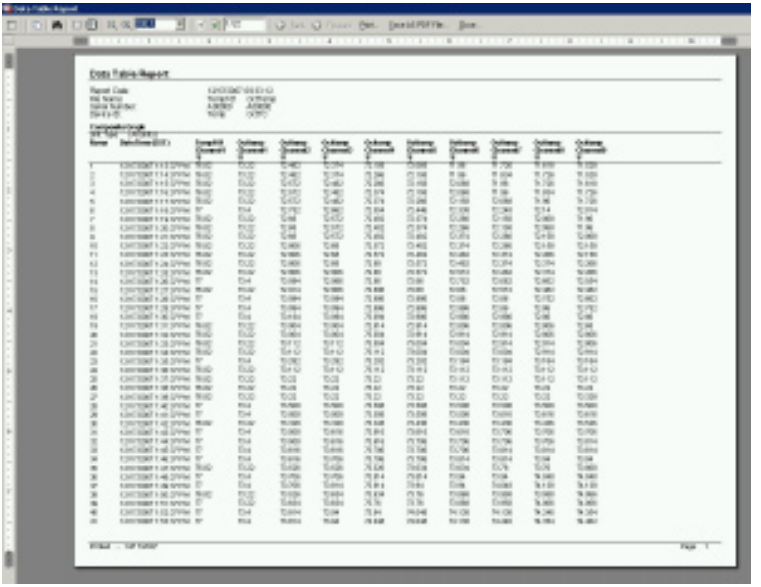


File Menu: Print Data

Select **Print Data** from the **File Menu** to print tabular data. The Data Table Report allows the user to customize their tabular data for general or reporting purposes. The amount of data will vary depending upon the selected data-sets and the reading ranges that selected by the user.

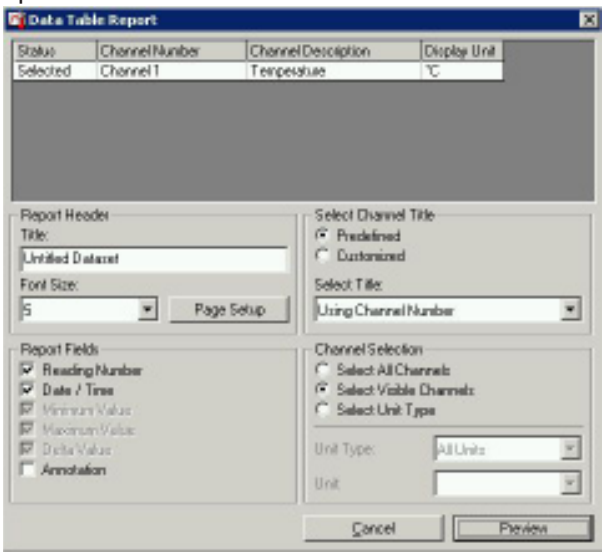
Preview Report (See Print Preview)

The window below is the sample of the report preview:



Single Graph Data File

To make a report for a single file, select the **Graph** Tab. Select **Print Preview** from the **File Menu.** There will be a check mark next to the **Print Preview** option. Select **Print Data** from the **File Menu**. The following form will appear:



List View (top of the form)

- The user can select or unselect the channels by clicking the cell of the **Status** column

Report Header

- The user can change the report title
- The user can change the font size for the report
- The user can setup the report page by clicking the **Page Setup** button (see **Page Setup**, page 19).

Select Channel Title

- The user can select the channel title by using predefined or customized options

Report Fields

- The **Minimum**, **Maximum** and **Delta** values are not available for the single graph report

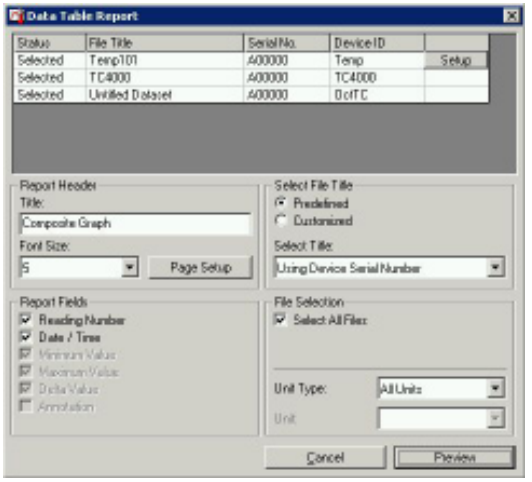
Channel Selection

- The user can select which channels to display
- The **Unit Type** and **Unit** fields are available if the user selects the **Select Unit Type** option button

Preview button

- Click the **Preview** button to preview the report of the single graph.

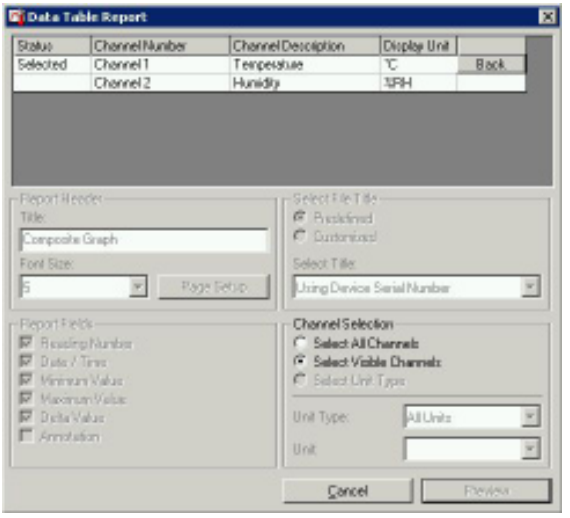
Composite Graph Data File



List View (top of the form)

- The user can select or unselect the channels by clicking the cell of the **Status** column. The **Setup** button will appear if the file is selected.

  Click the **Setup** button, the **Channel list view** appears (the channels list of the file will be displayed with a **Back** button).



Click the Back button to back to the file list view.

Report Header

- The user can change the report title.
- The user can change the font size for the report.
- The user can setup the report page by clicking the **Page Setup** button (see **Page Setup**, page 19).

Select File Title

- The user can select the file title by using predefined or customized options

File Selection

- The user can use the **Select All Files** check box to select all files
- The unit field is available if the user selects a specific unit type from the **Unit Type** field

Report Fields

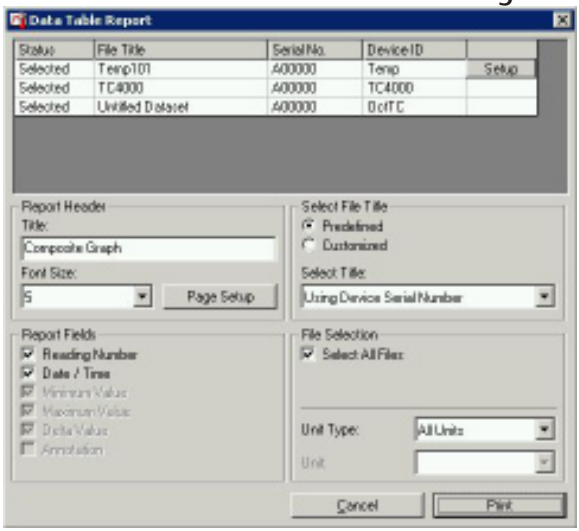
- The **Minimum**, **Maximum** and **Delta** are not available if **All Units** is selected as the **Unit Type.**

Preview Button

- Click the **Preview** button to preview the report of the composite graph.

Print Report

1) Print the report without the preview (uncheck the **Print Preview** option from the **File Menu**)
Click **Print Data** and the form **Data Table Report** appears as below.
Click the **Print** button and the **Print dialog box** appears.



2) Print the report from the preview

Click the **Print** button on the tool bar of the report preview window (see **Preview Report** page 22)

File Menu: Print Device Configuration

Select **Print Device Configuration** from the **File Menu** to print information that relates to the dataset file currently displayed on the screen.

Note: The message unable to print device configuration will inform the user if there is no dataset file open.

File Menu: Print Preview

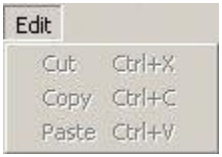
Select **Print Preview** from the **File Menu** to place a check mark next to it. When this menu item is checked, the result of **Print Graph**, **Print Data**, **Print Summary** and **Print Device Configuration** will display on the screen, rather than on the host printer. This allows a preview of the data to be printed. To uncheck this menu item select **Print Preview** again.

File Menu: Exit

Select **Exit** from the **File Menu** to close all open files and exit the program. There will be a prompt to save all files that have been changed

Edit Menu

The **Edit Menu** will appear as follows:



Edit Menu: Cut, Copy & Paste

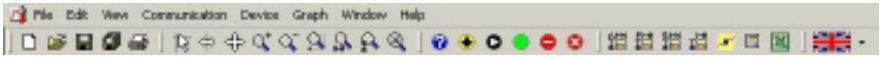
The **Edit Menu** toolbar is currently disabled.
The Cut, Copy and Paste functions are not available for use.

View Menu

The **View Menu** will appear as shown:

View Menu: Toolbar

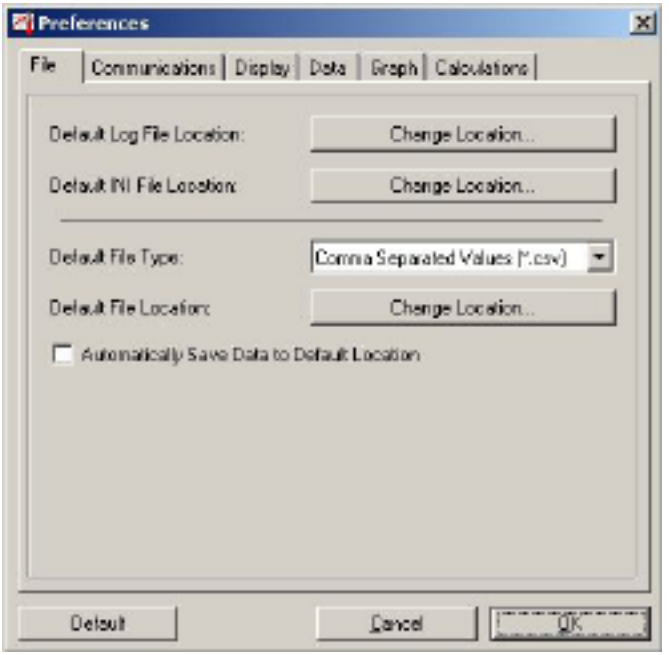
The **Toolbar** option is used to show or hide the toolbar located at the top of the screen. Hiding the toolbar allows more room for the graph being displayed.



View Menu: Status Bar

The Status Bar option is used to show or hide the status bar located at the bottom of the screen. Hiding the status bar allows more room for the graph being displayed.

Select **Preferences** to display the window shown below.



The following six tabs are found in this window: **File**, **Communications**, **Display**, **Data**, **Graph**, and **Calculations**. Each tab provides the ability to set preferences for a part of the program.

File Tab

Select the **File** tab from **Preferences Form**, to set the default file locations.

Default Log File Location

The **Default Log File Location** from the **Preferences Form** refers to the log files that are created while the software is running. Not all data loggers create a log file. The software appends a log file for each wireless transmitter when it receives a transmission. Through this option the user can change the default location where the log files are saved.

Default INI File Location

Select the **Default INI File Location** from the **Preferences Form** to refer to the initial settings the software will apply when it starts up. For those without read/write privileges, the INI File Location can be changed to a public folder for multiple users.

Default Data File Type

Select the **Default File Type** to choose from the list of file types in the drop down menu . The type can be changed when the file is saved, it is simply convenience setting. When checked, the data will be automatically be saved to the default file location that was selected in the file tab.

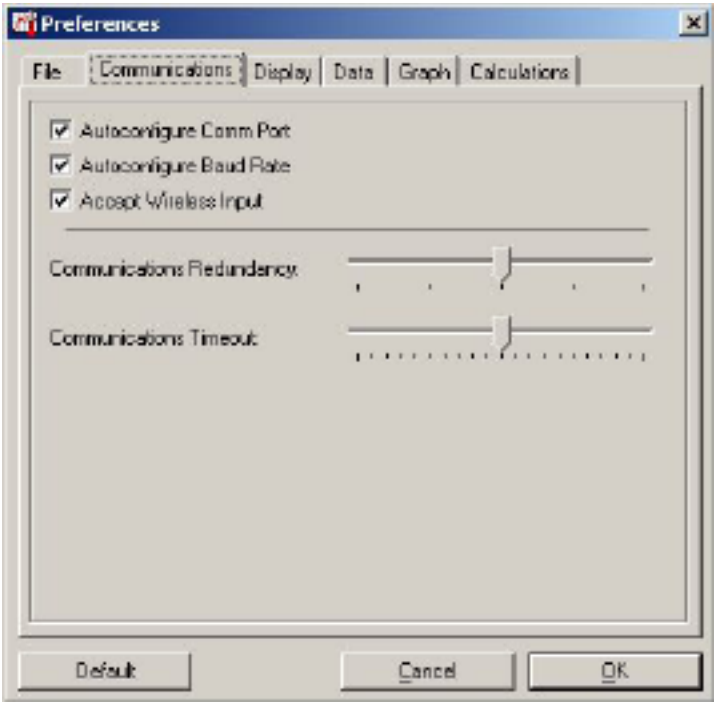
Note: This is limited to the data that was downloaded from the device to the computer (see Read Device Data, page 63).

Default Data File Location

Select the **Default Data File Location** from the **Preferences Form** to refer to the folder that the datasets are saved to. When the user **Saves** a file (page 17), the chosen directory will be the default save location. This can be changed when the user saves the file, it's simply a convenience setting.

Communications Tab

This tab sets various **Communications** preferences.



Autoconfigure Comm Port

Check this option to automatically configure the correct COM port in use to the host computer's . Leave this item checked unless the software is having trouble identifying the host computer's COM port (this happens rarely, usually only on older PCs). If this item is unchecked, the user must configure the Comm settings manually. See **Select Comm Port**, page 45.

Autoconfigure Baud Rate

Check this option to automatically configure the correct communications speed. Leave this item checked unless the software is having trouble identifying the host computer's COM port (this happens rarely, usually only on older PCs). If this item is unchecked, the baud rate must be configured manually. See **Select Baud Rate**, page 45.

Accept Wireless Input

Check this option to accept real time readings from the RF series of data loggers. To accept these readings the computer must have an RFC101A interface cable connected to an available COM port and the wireless RF logger or extender radios must be enabled to transmit.

Communications Redundancy

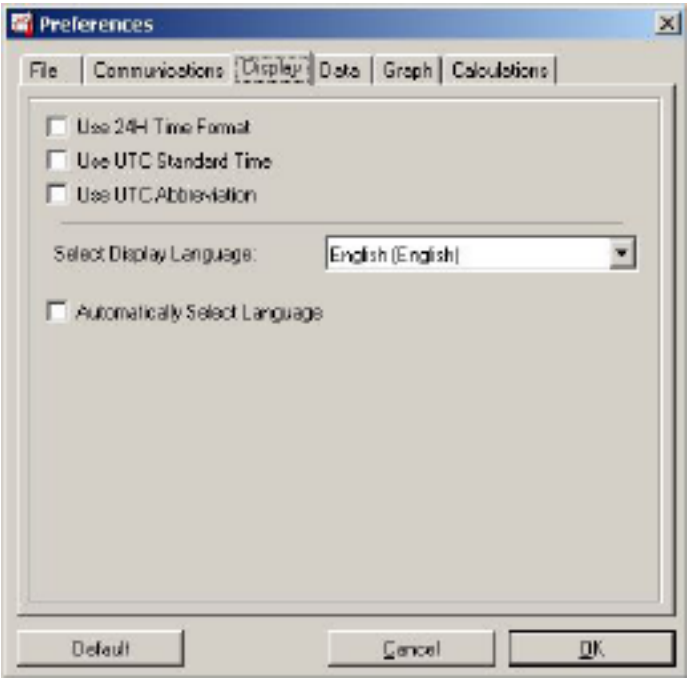
This refers to the number of times the PC will try to communicate with the logger. Setting the tab closer to the left will decrease the number of times it will try to communicate and setting the tab further to the right will increase the number of times it will try to communicate with the logger.

Communications Timeout

This refers to the length of time the PC will wait for the response from the data logger. Setting the tab closer to the left will decrease the amount of time the PC waits for a response, while setting the tab further to the right will increase the length of time the PC will wait. This setting is used when the user is has a device that takes a longer time to respond to the PC.

Display Tab

The **Display** Preferences tab sets display time and language settings.



Use 24 Hour Time Format

Check this box to use a 24-hour format. Leave it unchecked to use a 12-hour format.

Use UTC Standard Time

Check this box to use Universal Coordinated Time (UTC). Formerly known as Greenwich Mean Time (GMT).

Use UTC Abbreviation Time

Check this box to display the time zone that is relative to UTC time. If both the **Use UTC Standard Time** box and **Use UTC Abbreviation Time** box are unchecked then the system time of the PC will be displayed.

Select Display Language

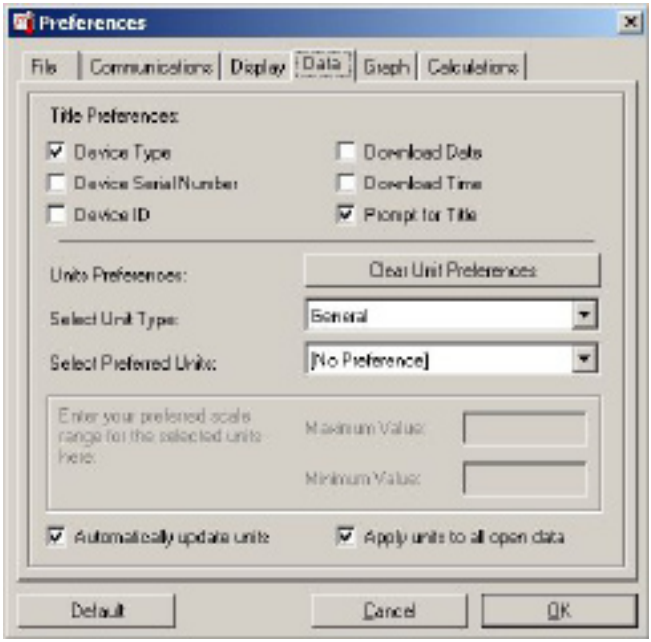
Choose the language to be displayed on the software from the language drop down list. The software toolbar command also offers the language choice.

Automatically Select Language

Check the **Automatically Select Language** box (see screen previous page) to choose the restarted software language as the computer system language and ignore the selected language. Unchecked the restarted software language is always the selected language.

Data Tab

The **Data** Preferences tab can set various data preferences.



Title Preferences

The **Title Preferences** settings determine which items appear in the Title of the dataset. If all boxes are unchecked untitled dataset will appear as the title name. The **Device Type, Device Serial Number, Device ID, Download Date**, and **Download Time** can be selected or unselected . Check the **Prompt for Title** box to prompt for a title each time, rather than generating its own title. These features must be enabled prior to downloading the data for them to apply.

Units Preferences

The **Units Preferences** settings determine the units used for the various types of measurements. In **Select Unit Type**, select the type of measurement from the dropdown list, then **Select Preferred Units** to use from the second dropdown list. The high point and low point range can be defined on the graph. This defines the **Preferred Scale**. See **Set Graph to Preferred Scale**, page 91.

Clear Unit Preferences

Select the **Clear Unit Preferences** button to set all unit preferences to the [No Preference] setting.

Automatically update units

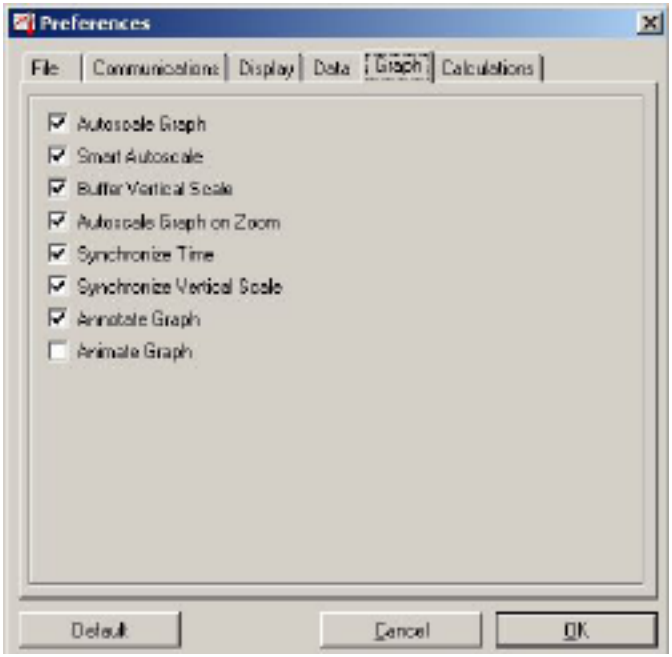
Check the **Automatically Update Units** option to allow preferred units to change when the corresponding units are changed on the screen.

Apply units to all open data

Check the Apply units to all open data option to trigger all corresponding units to change datasets on the screen. From this tab the graph preferences can be selected.

Graph Tab

In the **Graph** Preferences tab the graph preferences can be selected.



Autoscale Graph

Check the **Autoscale Graph** option to automatically optimize the vertical scale of the graph to match the minimum and maximum data points shown on the graph. This provides maximum resolution for viewing the graph.

Note: The Composite Graph will have the Autoscale Graph option applied if there are multiple datasets that have the Autoscale Graph option applied and un-applied.

Smart Autoscale

Check the **Smart Autoscale** option to round the vertical and horizontal scales to a tenth of a decimal point providing a slightly wider scaled range. If the option is off then the horizontal and vertical scales will be rounded to the thousandth.

Note: The Composite Graph will have the Smart Autoscale option applied if there are multiple datasets that have the Smart Autoscale option applied and un-applied.

Buffer Vertical Scale

Check **Buffer Vertical Scale** option to add an extra 10 measurements to the beginning and end ranges of the vertical scale, making the plotted lines centered in the graph.

Autoscale on Zoom

Check **Autoscale on Zoom** option to automatically scale the graph when zooming in using the horizontal zoom tool only.

Synchronize Time

Check **Synchronize Time** option to view multiple graphs which only affects the composite graph tab. When checked, multiple datasets will be shown over a scaled period of time through the composite graph. When unchecked the multiple datasets will instead overlap each other and the time shown is directly related to which graph the cursor has selected.

Synchronize Vertical Scale

Check **Synchronize Vertical Scale** option to view multiple graphs which only affects the composite graph tab. When checked multiple datasets are shown with scaled vertical ranges, meaning each parameter (temperature, humidity, etc.) will have one default set range for each parameter. When the option is unchecked each plotted graph will have its own individual scaled vertical range.

Annotate Graph

Check **Annotate Graph** option to permit all annotations be viewed on the computer screen, this option is beneficial when printing the annotations. When this option in unchecked, the data can still be annotated, yet it is not visible on the screen unless that data point has been clicked, whereas the annotation appears in the top left hand corner of the graph.

Animate Graph

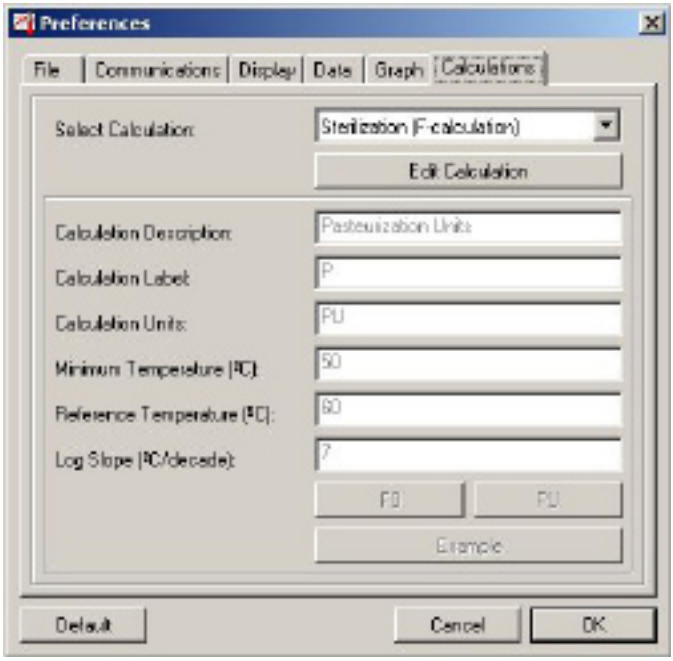
Check the **Animate Graph** option to create blinking maximum and minimum alarm setting lines on the screen.

Calculations Tab

In the **Calculations** Preferences tab various calculations preferences can be set.

Edit Calculation

Select the **Edit Calculation** button, the following window will appear:

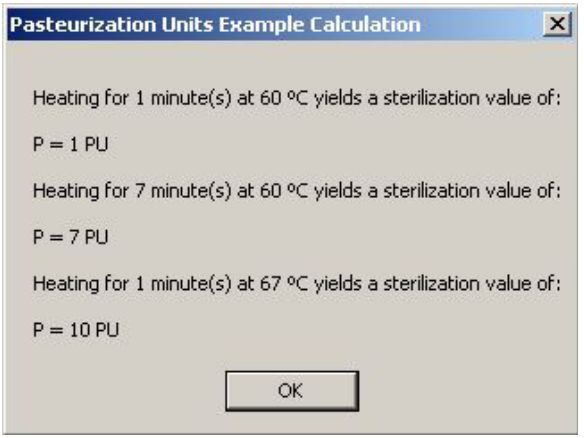


F0

Select the F0 button to display the settings for F0, a common unit of sterilization.

PU

Select the PU button to display the settings for pasteurization units.


Pasteurization Units Example Calculation
Heating for 1 minute(s) at 60 °C yields a sterilization value of:
P = 1 PU
Heating for 7 minute(s) at 60 °C yields a sterilization value of:
P = 7 PU
Heating for 1 minute(s) at 67 °C yields a sterilization value of:
P = 10 PU
OK

For more information about calculation units go to www.madgetech.com. From the menu bar at the top of the MadgeTech home page, select **Technical Notes,** then select **Sterilization and Pasteurization Units Application Note**.

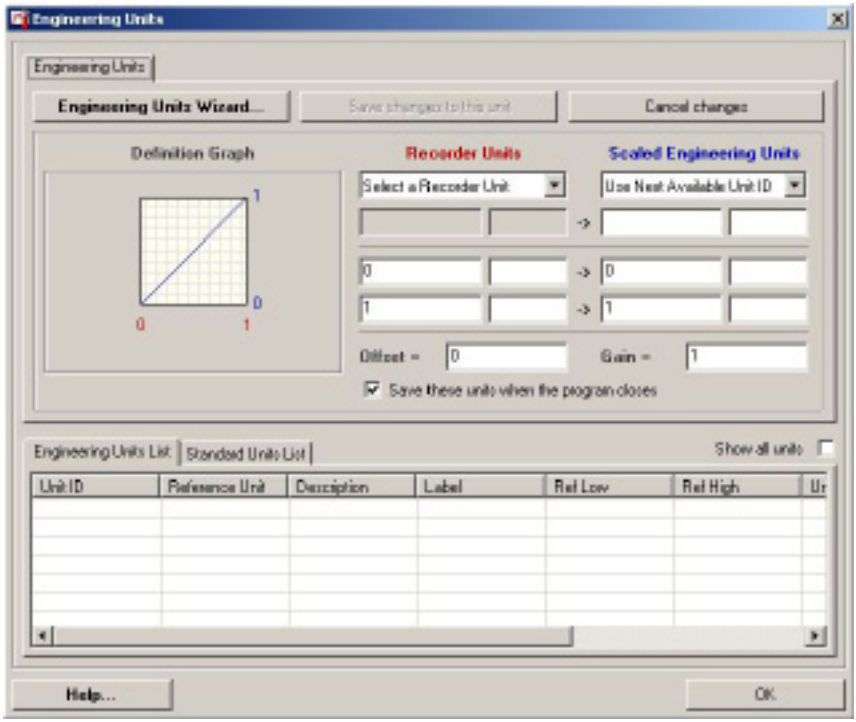
Engineering Units (software level)

This is a MadgeTech software feature which allows the customization of engineering units. These units are software level units (saved in the software specific to user's PC not the device) and their functions are the same as non-customized units.

Note: There are two types of engineering unit levels (software and device). The user can manipulate the software level engineering units whenever the software is on, but the device level is only available to edit when the connected device supports engineering units. See Device Level Engineering Units, page 53 for details.

View Menu: Engineering Units (software level)

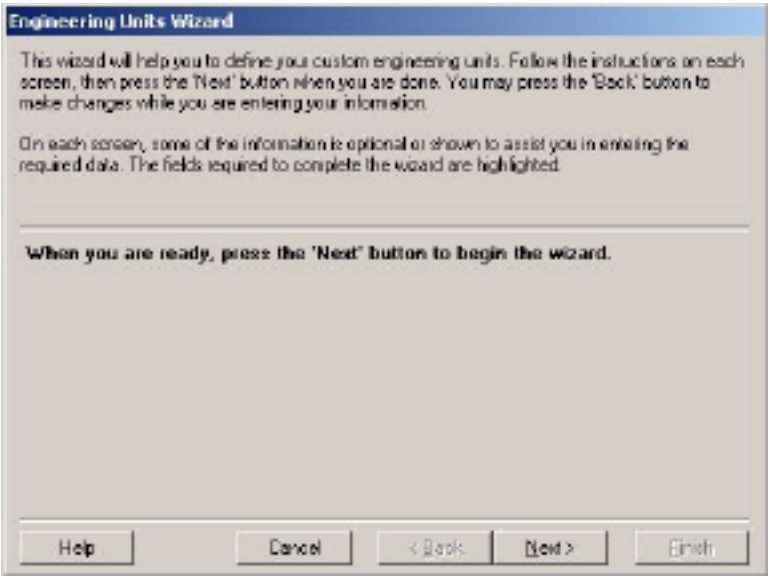
Select Engineering Units from the View Menu (page 27) to display the following window:



Create **Engineering Units** by using the **Engineering Units Wizard** button (see screen previous page) or **Create a new unit** button on bar, below.

Engineering Units Wizard

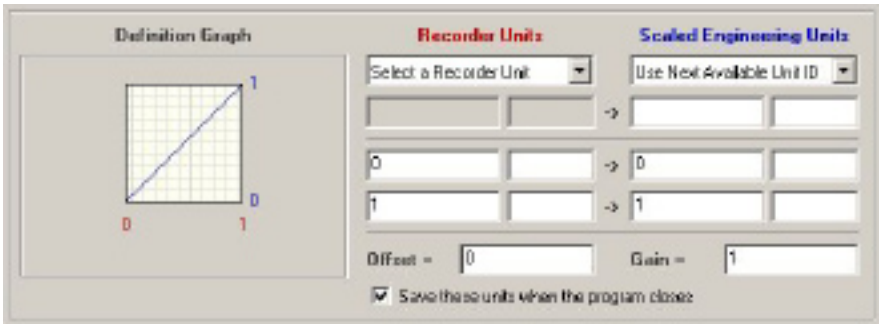
Select the **Engineering Units Wizard** button to bring up the Engineering Units Wizard window in the following screen.


Engineering Units Wizard
This wizard will help you to define your custom engineering units. Follow the instructions on each screen, then press the 'Next' button when you are done. You may press the 'Back' button to make changes while you are entering your information.
On each screen, some of the information is optional or shown to assist you in entering the required data. The fields required to complete the wizard are highlighted.
When you are ready, press the 'Next' button to begin the wizard.
Help
Cancel
< Back
Next >
Finish

The wizard will calculate the engineering unit based on the input.

Edit Engineering Units

If the box below is enabled, the engineering units can be edited directly. Otherwise, choose the **Create a new unit** button (see previous page) or highlight a record from the **Engineering Units** list to enable this section.



Definition Graph

The **Definition Graph** compares **Recorder Units** and **Scaled Engineering Units** when data is input for the engineering units.

Recorder Units

Select a Recorder Unit must be selected based on the type of parameter being converted. Input the low/high reference values. When no specific unit is displayed the **Select a Recorder Unit dropdown list** (Fig. 1) will contain all available units, otherwise, it will only contain the unit that relates to the displayed unit (Fig. 2) as shown below.

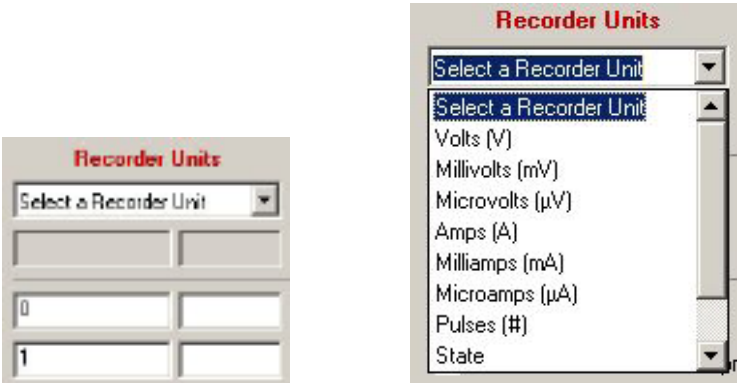


Fig. 1

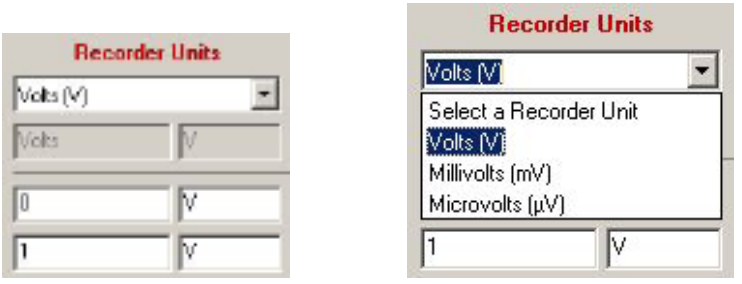


Fig. 2

Scaled Engineering Units

The **Scaled Engineering Units** (see screen shot page 41) requests the description, label, and low/high unit values of the engineering unit.

The description field allows the full name of the parameter to be displayed in the software. Examples of this are Volts, Milliamps, pH, Gallons, etc. This name is displayed on the graph and data table as the description of the data.

The label field allows the label of the parameter to be displayed in the software. Examples are V, mA, pH, G, etc.

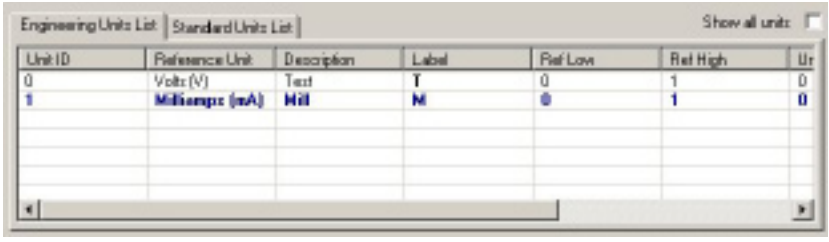
The gain and offset fields are the equivalent of the "m" and the "b" respectively in the "Y = m * X + b" equation. X is the raw data from the device and Y is the data displayed by the software.

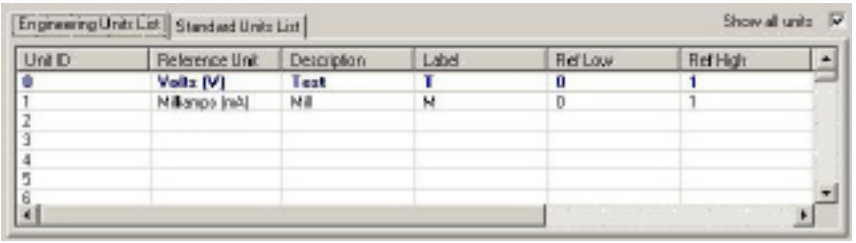
Choose the **Scaled Engineering Units** dropdown list to select the unit ID. If Use **Next Available Unit ID** is set as the default, the software will assign the next available unit ID to the created unit.

If the checkbox **Save these units when program closes**, screen shot bottom of Edit Engineering Units, is checked when the program closes, the created unit will be saved in the software after the software is closed. Otherwise, the created unit will be lost after the software closes. Edit a unit and uncheck this box to remove the unit from the list.

Engineering Units List

The **Engineering Units List** tab will display all the customized engineering units. To edit a record, highlight it. The information will be displayed in the **Edit Engineering Unit's Recorder Units** section (see previous page).

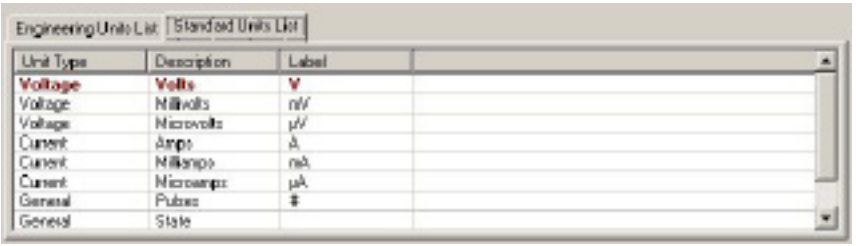




Note: The Show all units checkbox defines the status of both Engineering Units List tab and Use Next Available Unit ID dropdown list box. If checked, all available unit ID's will be displayed on both fields. The unit ID range is 0-255.

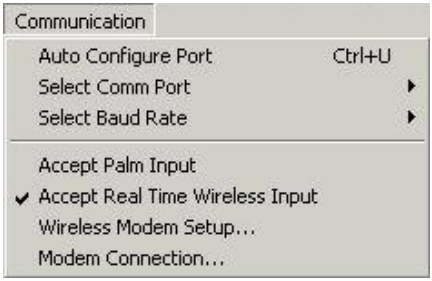
Standard Units List

The **Standard Units List** tab will display all the available unit type(s) that can be used to make customized engineering units.



Communication Menu

The **Communication Menu** displayed below



Communication Menu: Auto Configure Port

Select **Auto Configure Port** from the **Communication Menu** to automatically indicate which COM/USB port the device is attached and which baud rate the device uses to communicate. This command operates only when an interface cable is connected to an available COM/USB port and a functioning data logger. If this command fails to find the device, then the device is not functioning properly or the interface cable is not properly connected. Once the software has identified the COM/USB port and the proper baud rate, the information will be stored in the configuration file. This command only needs to be activated once. If a different COM/USB port is later used, or if a device with a different baud rate is used, then re-select the command.

Communication Menu: Select Comm Port

Select the **Comm Port** to manually set/choose the communication/USB port in which to connect the data logger. The correct COM/USB port must be selected or the software will not to communicate with the data logger. To automatically configure this option, refer to **Auto Configure Port**, above.

Communication Menu: Select Baud Rate

Select the **Baud Rate** from the **Communication Menu** to manually set the speed to use to communicate with the data logger. The correct baud rate must be selected, to allow the software to communicate with the data logger. To automatically configure this option, refer to **Auto Configure Port**, above.

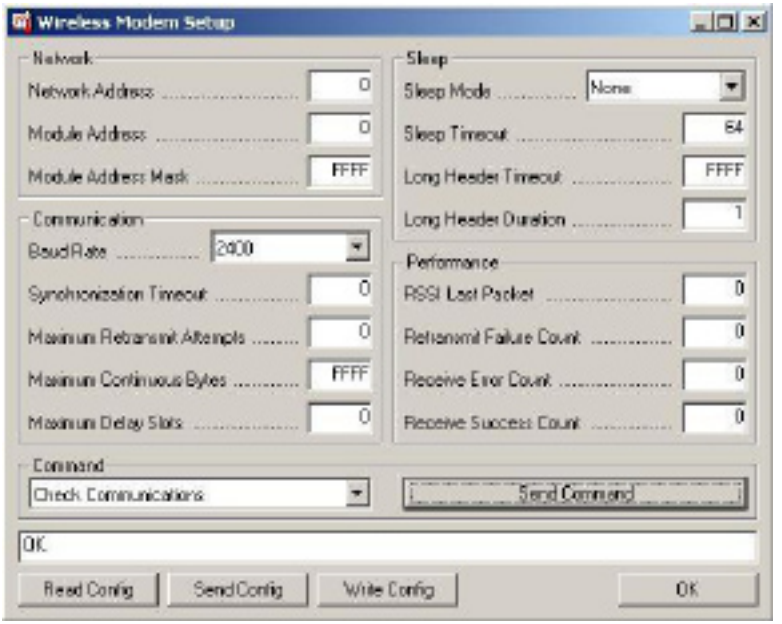
Communication Menu: Accept Real Time Wireless Input

Selecting **Accept Real Time Wireless Input** from the **Communication Menu** enables the software to accept real time readings from wireless transmitting devices. To accept these readings, the computer must have an RFC101A interface cable connected to an available COM port and the transmitter must be enabled to transmit.

Note: The RFC101A has a baud rate of 4800. The user must manually configure this baud rate. See Communication Menu: Select Baud Rate, page 45.

Communication Menu: Wireless Modem Setup

Select **Wireless Modem Setup** from the **Communication Menu** to activate the following window:



This window allows the user to enter the RF Extender settings. The RF Extender allows the MadgeTech data logger to be remotely accessed up to one mile away from a computer, for more information about RF Extender see Quick Start Menu and Operations Manual for RF Extender Setup at www.madgetech.com. Not all data loggers are capable of wireless remote operation.

Network

The **Network** (the host computer's network) **Address** and **Module** (the RF Extender) are used to distinguish the RF devices from other devices. The **Network Address** can be configured for up to 7 different networks (0-6). The **Module Address** can be configured for up to 65536 different addresses (0-65535).

Communication

The **Baud Rate** parameter may need to be changed. Select the baud rate in the **RF Extender** dropdown list from the drop down menu to match the baud rate of the data logger which will communicate with the RF Extender. Keep the other default RF Extender settings unless they are required to be changed.

Send Command

Select the **Send Command** button to use with the **Command** dropdown list.

Read Config

Select the **Read Config** button to display the RF Extender's current configuration.

Write Config

Select the **Write Config** button to store the configuration in the non-volatile memory where it will not be lost when the power is cycled.

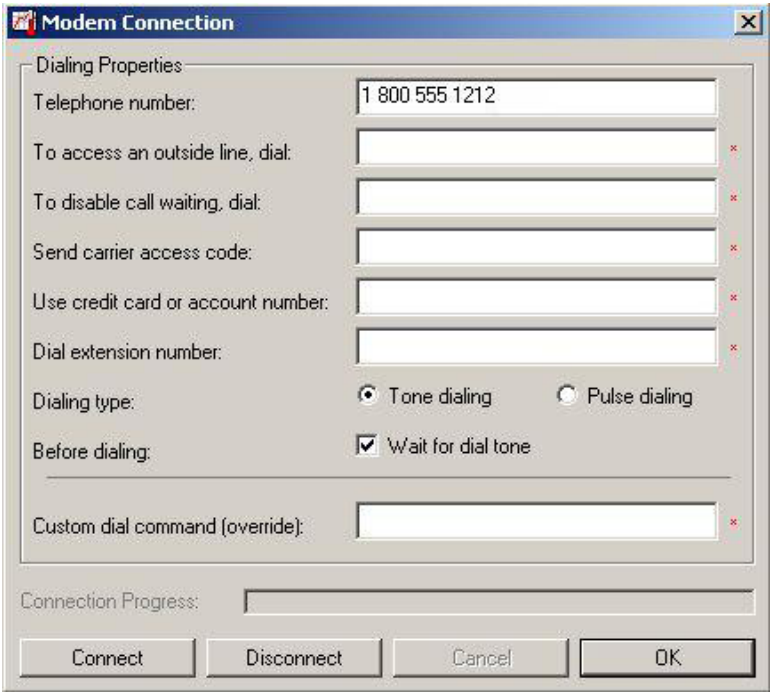
Send Config

Select the **Send Config** button to store the configuration in the temporary buffer where it will be lost when the power is cycled.

All other configuration fields are not necessary by default.

Communication Menu: Modem Connection

Select **Modem Connection** from the **Communication Menu**, page 45, to the following window:



Enter the telephone number (required) and other modem settings (not required, marked by red asterisk) in this screen. The software will read data from a remote device equipped for modem data transfer, not all data loggers are capable of remote operation.

Connect Button

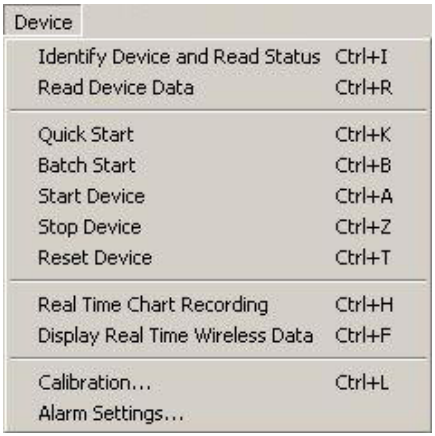
Select the **Connect** button to connect to the remote station.

Disconnect Button

Select the **Disconnect** button to disconnect from remote station.

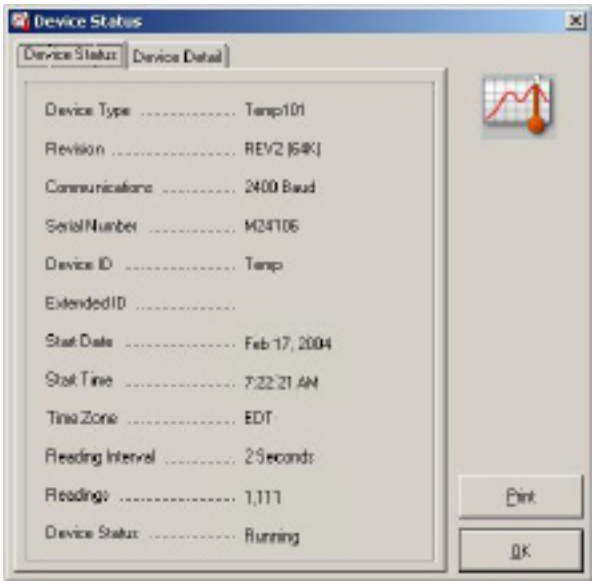
Device Menu

The **Device Menu** will appear as shown:



Device Menu: Identify Device and Read Status

Select **Identify Device** and **Read Status** from the **Device Menu** to allow software to communicate with the attached data logger and display a window similar to this one:



Device Status Tab

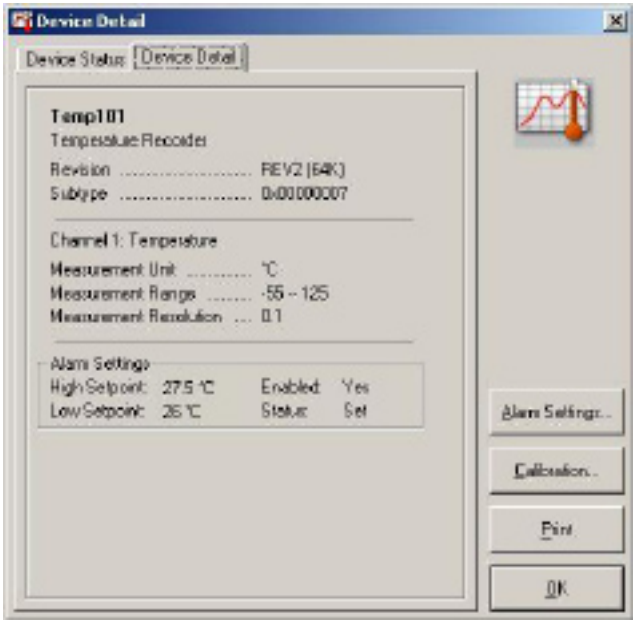
The **Device Status** tab displays the device type, revision number, serial number, **Extender** (user) **ID**, and operating parameters of the particular device in the **Device Status** dialog box. The serial number is set at the factory and cannot be changed by the software. The **Device ID** can be selected when starting the device. This command will also verify that the software is able to communicate with the device and that the correct COM/USB port has been selected. If the device does not communicate, verify the following:

- Are the COM/USB port and baud rate correct?
- Is there another device using the selected COM/USB port, such as a modem or PDA?
- Is the device's battery dead?
- Is the Interface Cable connected to the correct COM/USB port?

In addition, this command will read and indicate the current status and all pertinent information of the device that is connected. This provides a quick method for determining the current state or status of a particular device.

Device Detail Tab

The **Device Detail** tab displays the details of the device. An example of a Temp101 data logger is seen in the screen below:



The details include device type (device name as heading), revision number, subtype, and channel information. Information about Alarm Setting, Thermocouple Type, Engineering Units, Trigger Settings, Wireless Configuration, Wrap Around and Calibration will be displayed when the device supports these features.

Note: When these features exist, a corresponding button will be displayed on the lower right side of the screen. An Alarm Settings & Calibration button are displayed in the example on the screen above.

The following details are described as follows:

Alarm Settings

Select **Alarm Settings** to display an alarm setting screen that will permit the alarm range to be changed. See page 81 for full operating instructions.

Set Password

Click **Set Password** to password protect the device.

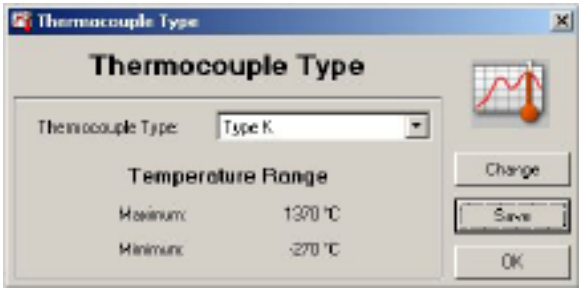
Password doesn't exist.

The software will remember the device password after it has been set. The password will be asked next time when the user analyzes the device data.

Password exists.

Thermocouple Type

Select **Thermocouple Type** to display a thermocouple type window to request the input of the thermocouple type being used. This command is only available for devices that use thermocouples as the sensing element, such as the TC4000, TC110, QuadTemp, and OctTemp. The device will configure itself appropriately for the chosen type of thermocouple. The device requires this information to properly make temperature measurements and automatically perform the thermocouple cold junction compensation. Upon activation of this command, the software communicates with the device to determine if it has a programmable thermocouple attached. If it does, the following window appears:

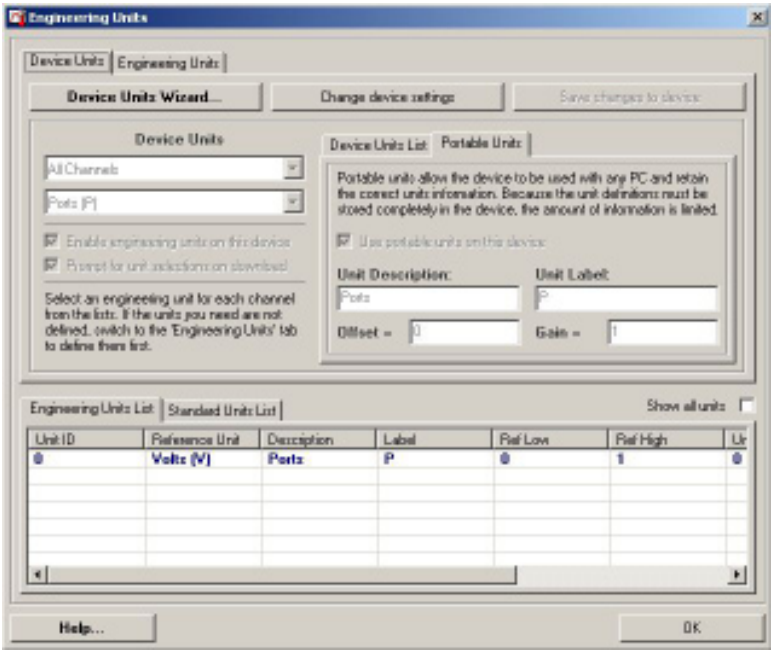


To change the thermocouple type, select the **Change** button. To commit the change, select **Save** to store the thermocouple type in the device. After selecting the thermocouple type, the temperature range for the chosen thermocouple is automatically displayed.

Engineering Units (device/software level)

The **Engineering Units** command is only available when a data recorder with this feature is connected to the host computer. Multiple engineering units can then be defined into multi-channel recorders.

Note: If the software level engineering units does not have the record of device engineering unit, a new software level record of device engineering unit with an unique unit ID will be created when Identify Device and Read Status are performed (see page 49).



1. Device Units

The **Device Units** tab contain the engineering unit(s) of the device connected to the host PC. The **Device Units Wizard** button (1) will automatically edit the device's engineering units or it can be done manually using the **Change device settings** button (2). Save the changes into the device select the **Save changes to device** button (3).

(1) **(2)**

(3)

A. Device Units Wizard

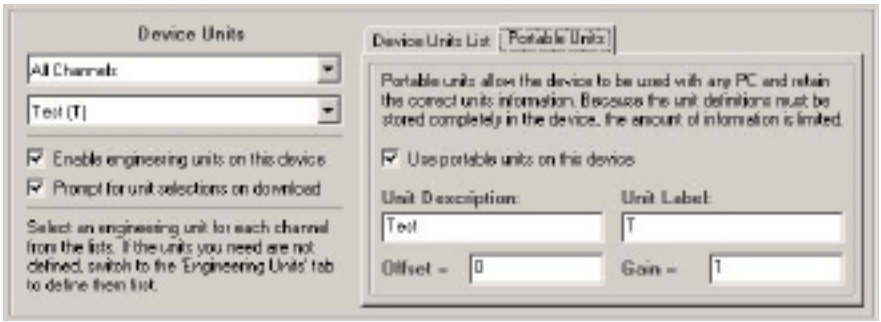
The **Device Units Wizard** will calculate the device unit(s) based on the user's inputs.

Device Units Wizard
This wizard will help you to set up your logger to display your custom engineering units. Follow the instructions on each screen, then press the 'Next' button when you are done. You may press the 'Back' button to make changes while you are entering your information.
On each screen, some of the information is optional or shown to assist you in entering the required data. The fields required to complete the wizard are highlighted.
When you are ready, press the 'Next' button to begin the wizard.
Help
Cancel
< Back
Next >
Finish

B. Edit Device Units

When **Edit Device Units** is enabled, the engineering units of the device can be edited directly. Otherwise the user needs to select the **Change device settings button** (see buttons on previous page) to enable this part first.

Note: The Use portable units on this device checkbox defines the status of two dropdown list in the Device Units field. If it is checked, both of the dropdown lists will show all channels and portable units.


Device Units
All Channels
Test (T)
Enable engineering units on this device
Prompt for unit selections on download
Select an engineering unit for each channel from the lists. If the units you need are not defined, switch to the 'Engineering Units' tab to define them first.
Device Units List
Portable Units
Portable units allow the device to be used with any PC and retain the correct units information. Because the unit definitions must be stored completely in the device, the amount of information is limited.
Use portable units on this device
Unit Description:
Test
Unit Label:
T
Offset =
0
Gain =
1

Enable Engineering Units

The **Enable engineering units on this device** option indicates if the units programmed into the device should be displayed when data is downloaded.

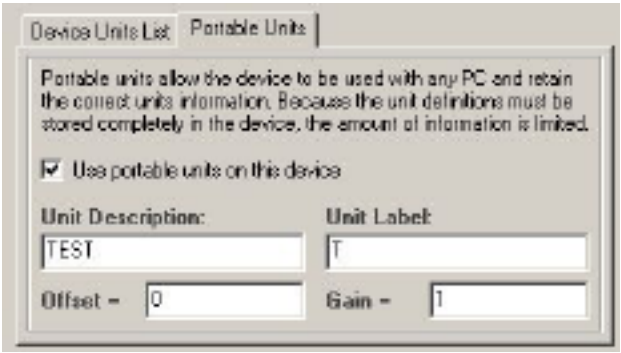
Prompt for unit selections on download

The **Prompt for unit selections on download** option allows the stored information to be edited each time the data is uploaded.

Portable Units

The **Portable Units** tab contains description, label, gain, and offset fields.

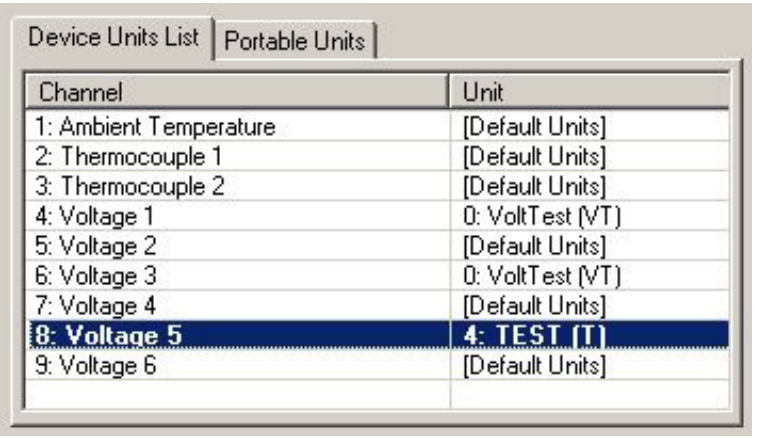
The description field is used to enter the full name of the parameter to be displayed in the software. Examples of this are Volts, Milliamps, pH, Gallons, etc. This name is displayed on the graph and data table as the description of the data.


Device Units List
Portable Units
Portable units allow the device to be used with any PC and retain the correct units information. Because the unit definitions must be stored completely in the device, the amount of information is limited.
Use portable units on this device
Unit Description:
TEST
Unit Label:
T
Offset =
0
Gain =
1

The label field is used to enter the label of the parameter that is to be displayed in the software. Examples are V, mA, pH, G, etc. The gain and offset fields are the equivalent of the “m” and the “b” respectively in the “Y = m * X + b” equation. X is the raw data from the device and Y is the data displayed by the software.

Device Units List

The **Device Units List** tab shows all channels and their corresponding unit.

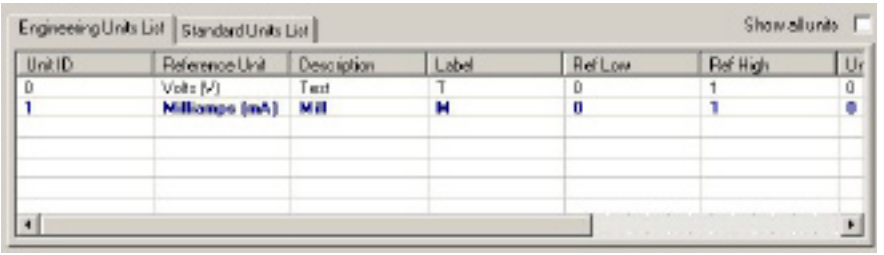


Note: To assign the engineering unit to the specific channel, select the channel and choose the record from Engineering Units List (see below). If the unit assigned to the channel is a software level (not device level) engineering unit then the Use portable units on this device option in Portable Units will be unchecked.

Engineering Units List	
Unit Description	Unit Label
Speed	m/s (meter/scale)
Concentration	PPM
Pressure	PSI
Metering	Watts, gallons
Level	Inches
pH	pH

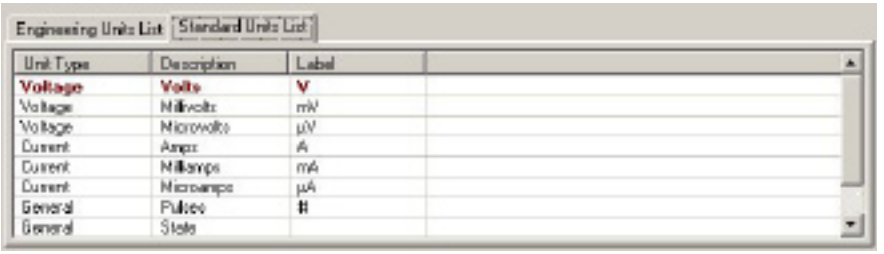
Engineering Units List

The function of the **Show all units** checkbox is described in **Software Level Engineering Units List**, page 53.



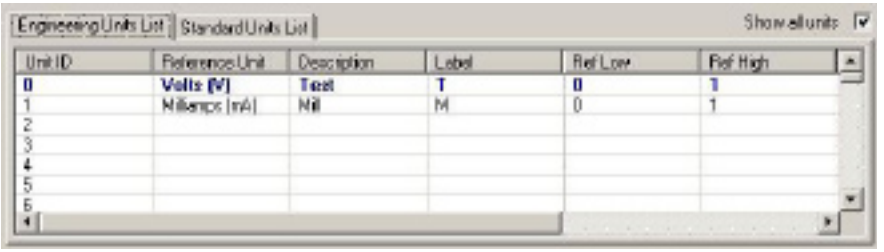
Standard Units List

The **Standard Units List** tab will display all the available unit types that can be used to make customized engineering units.



2. Engineering Units

The **Engineering Units** tab will be the same as **Software Level Engineering Units**, page 53.



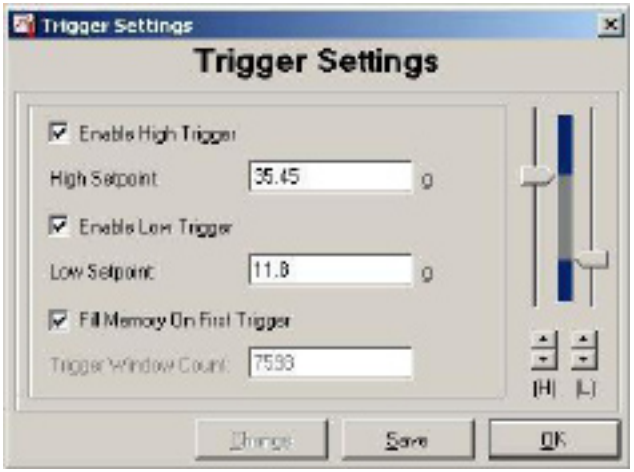
Note: The edibility of the Device Units and Engineering Units tabs will be opposed so they cannot be edited at same time.

Trigger Settings

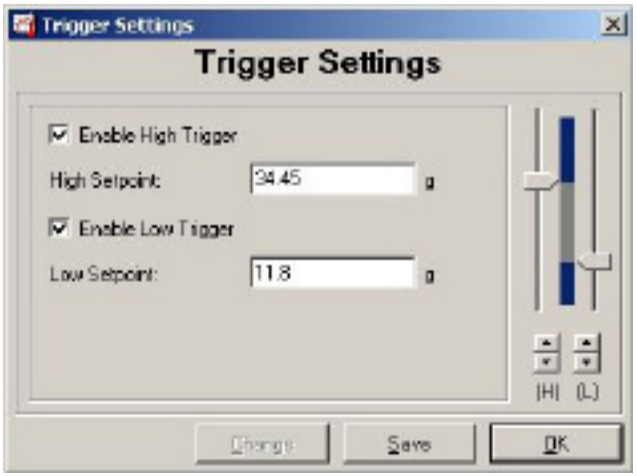
Select **Trigger Settings** from the **Device Menu: Start Device** or **Identify Device and Read Status**. This command is only available when the data recorder has the Trigger feature. The trigger screens offered depend on the type of data recorder connected to the host computer. Trigger screen samples are shown below.

Device has one triggered channel

Trigger formats with one mode of operation fall into two types: With or Without settable sample count.



Trigger Form 1:
With sample count



Trigger Form 2:
Without sample count

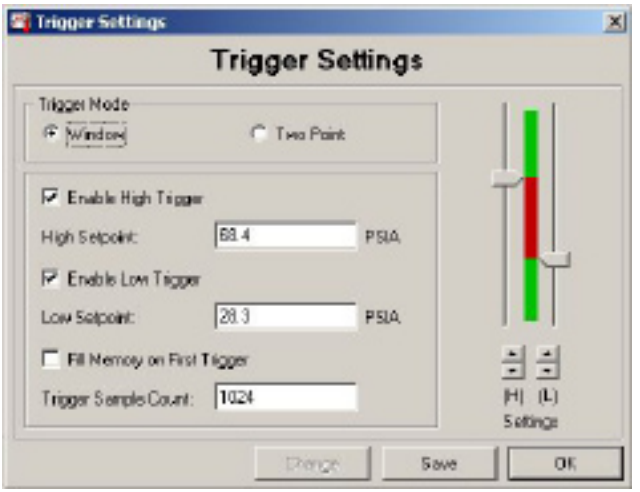
To edit trigger values, click the **Change** button. The values can be typed in directly, or changed using the slider control.

NOTE: The high and low triggers cannot be disabled simultaneously.

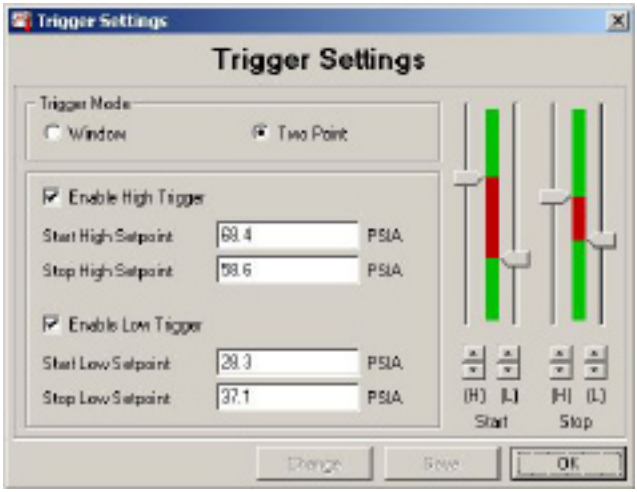
The values for the high or low trigger points can be set. Enable the high trigger to allow the acquisition of data to begin if the point is greater than the high set point. Enable the low trigger to allow the acquisition of data to begin if the trigger level is less than the low set point. The trigger sample can be set up to count by;

1. Typing in their readings count number or
2. Select **Fill Memory on First Trigger** option to get the maximum reading counts on a single event.

Trigger formats with two trigger mode options fall into two types: Window and Two Point.



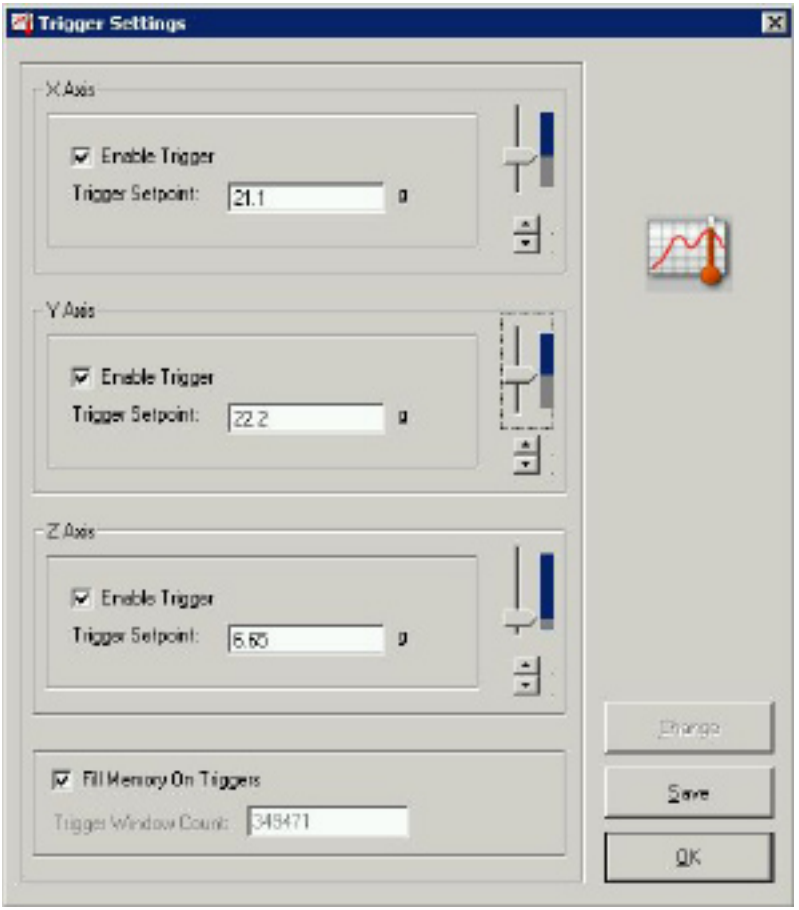
Trigger Form 3: Window, the function of this form is similar to Trigger Form 1



Trigger Form 4:
Two Point Mode

Two Point Mode allows for a High Trigger and Low Trigger. There will be two separate areas of pressure that can enable a trigger.

Device has three triggered channels



To edit trigger values, click the **Change** button. The values can be typed in directly, or changed using the slider control.

NOTE: At least one axis must be selected.

Calibration

Select **Calibration** to display a calibration screen that will permit the device to be calibrated. See page 79 for full operating instructions.

Device Menu: Read Device Data

To download the data from the device to the computer, select **Read Device Data** from the **Device Menu**. This command automatically downloads all the stored data from the device and displays it in both graphical and tabular format. The standard Temp101 will download data at approximately 120 readings per second. A progress bar located near the bottom of the screen gives a visual indication of how long the download will take.

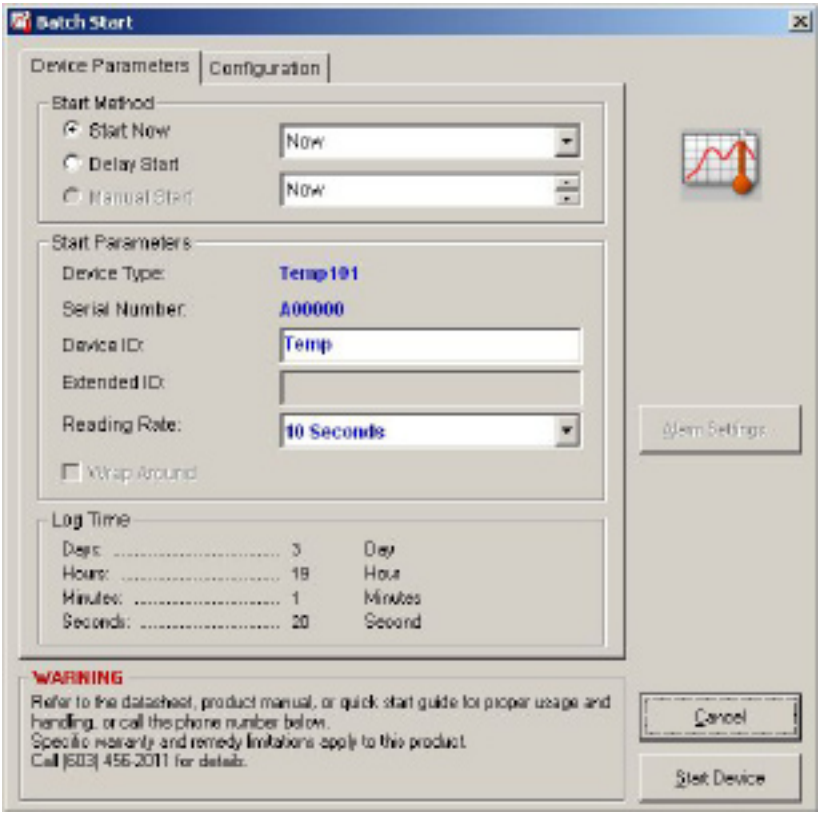
Note: The data logger continues to record after the data has been downloaded. Use Stop Device, page 69, to stop the data logger from taking readings.

Device Menu: Quick Start

Select **Quick Start** from the **Device Menu** to start the device without asking for any settings. It will use the previously set user ID and reading rate. This is useful for saving time, especially when programming multiple devices with the same parameters.

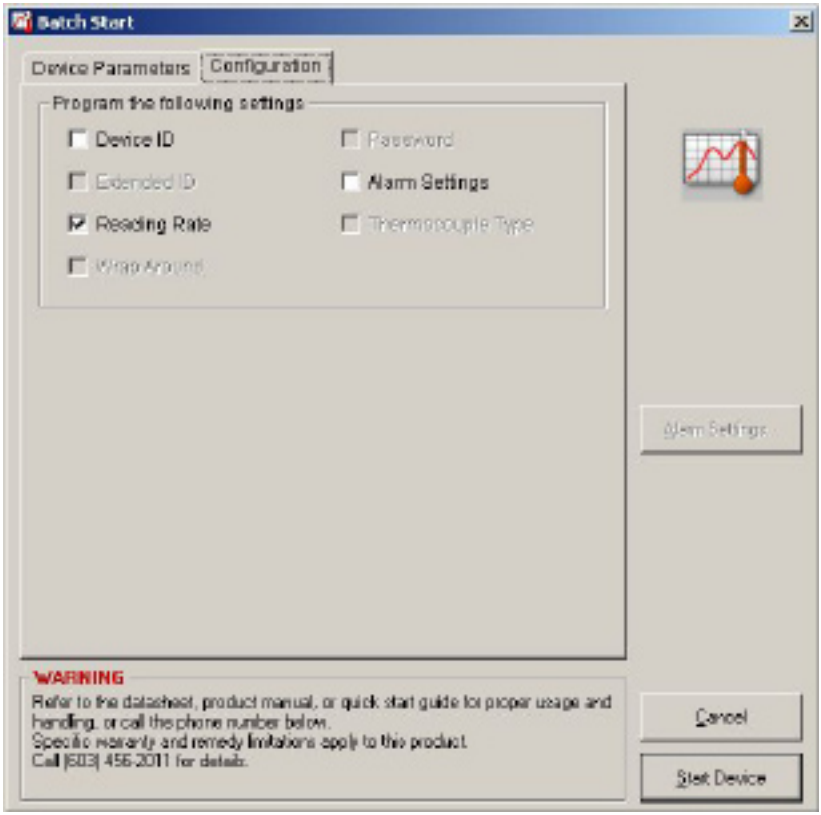
Device Menu: Batch Start

Select **Batch Start** from the **Device Menu** to display the following window:



Device Parameters Tab

The **Device Parameters** tab has similar functions to **Start Device** (page 66). The availability of Device ID field, Extended ID field, Reading Rate, and Wrap Around field (option available depending on device) depends on the selections in the **Configuration** tab. If the device has the alarm setting feature then a corresponding button will be displayed on the screen. An **Alarm Settings** button is displayed on the screen above.



Configuration Tab

The **Configuration** tab has five selectable parameters; **Device ID** , **Extended ID** , **Reading Rate** , **Wrap Around** , and **Alarm Settings** options. The availability of these fields depends on the features the device supports.

Device ID

Check the **Device ID** box to give the device up to a 6-character name in the **Device Parameters** tab.

Extended ID

Check the **Extended ID** box to give the device an additional 16-character name in the **Device Parameters** tab.

Password

If the device has the Password feature then the **Password** box is enabled and a password button appears on the right side of the screen which allows editing **Device Password**.

Alarm Settings

Check the **Alarm Settings** box to enable the alarm setting feature from the **Device Parameters** tab (screen previous page).

Reading Rate

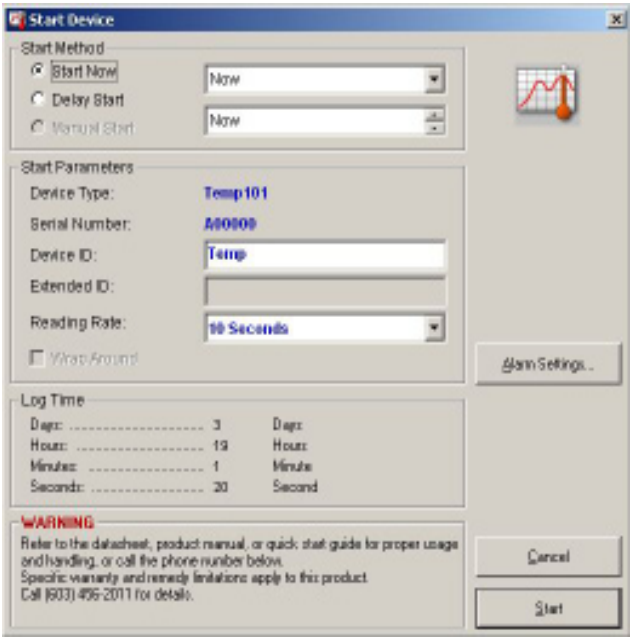
Check the **Reading Rate** box to choose the reading rate from the **Device Parameters** tab.

Wrap Around

Check the **Wrap Around** box to choose the wrap around memory feature from the **Device Parameters** tab.

Device Menu: Start Device

Select **Start Device** from the **Device Menu** to display the following window:

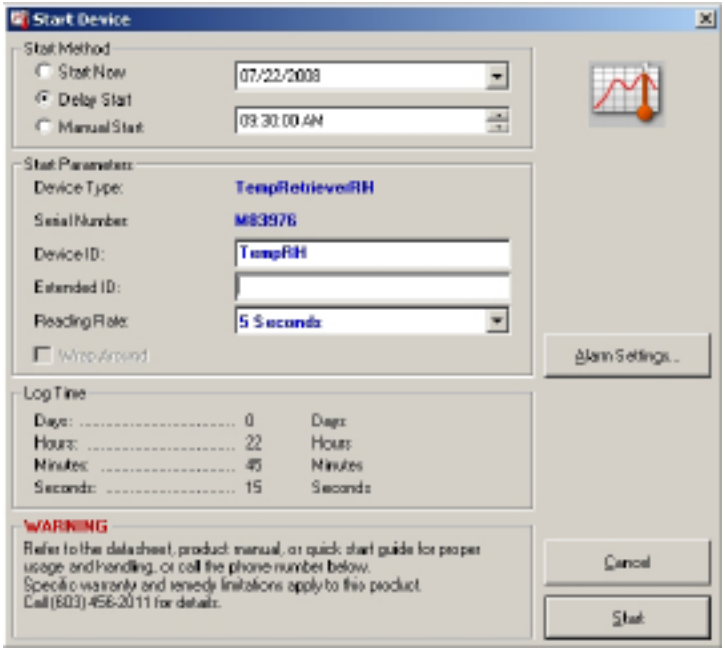


Note: Starting the device will erase all readings currently stored in its memory.

The **Start Device** window allows the start time and reading rate to be set. The **Start Method** setting may be used, along with the **Start Now** radio button, to start the data logger immediately. Alternatively, the user can select the **Delay Start** option to delay the start of data collection. The start time may be delayed up to six months from the current time. The **Pushbutton Start** option can be selected to start the data logger by pushing the push-button on the device. **The push button must be pushed down and held for at least 3 seconds.**

When the device has a feature such as alarm setting, thermocouple type, trigger settings, wireless configuration and engineering units then a corresponding button will be displayed on the screen. An **Alarm Settings** button is displayed in the example below in the lower right hand portion of the screen.

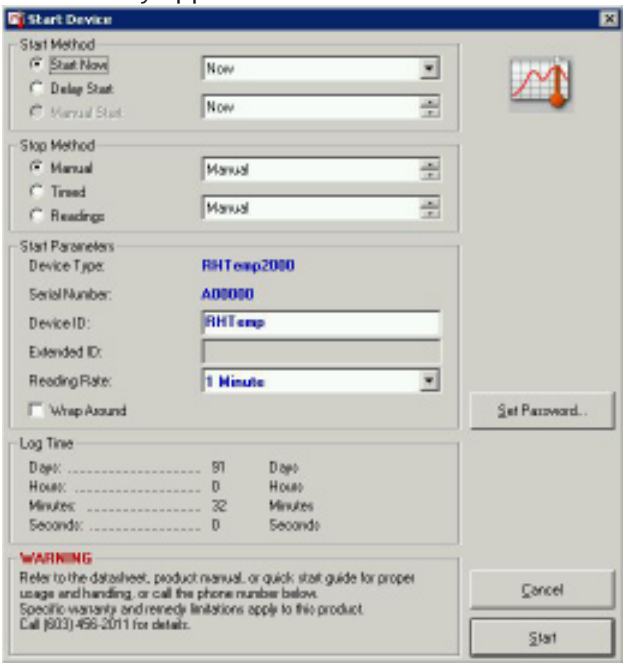
For some types of data loggers, the following window may appear:



The device start time may be delayed after the start button of the data logger has been pushed. This time will depend on the value of the delay start.

The reading rate can be selected to determine its data recording frequency. When selected, the maximum recording time will be calculated for the particular device, based on its internal memory capacity, and displayed in **Log Time** box. Once started, the device will continue to record readings until its memory is full, unless the **Wrap Around** feature is enabled. When full, the data recorder will stop recording additional readings, then place itself into a low power state to maximize battery life. The data stored in the data logger is always preserved (even in the case of battery failure) unless the device is reset or started. When re-started the existing readings are then overwritten.

For some types of data loggers which have the stop feature, the following window may appear:



Manual Stop (default option for logger operation)

The device will continue to record data until the memory is full, or until the device is stopped manually using the MadgeTech software.

Stop on Date

The user can specify a time at which the device will stop taking readings to memory. A stop date can be specified up to a year in advance.
Note: If the Wrap Around feature is activated a stop date will not be possible to set.

Stop after Readings

The user can specify the number of readings the device will take. Any number of readings can be specified up to the maximum number of readings supported by the device.

Note: If the Wrap Around feature is activated a stop date will not be possible to set.

Device ID

A **Device ID** may be entered in the space provided in any combination of six letters and/or numbers. The Device ID is written to the device and will appear in graphs or reports when the device is read later. Use it for identification of the device or personnel linked to the device, etc.

When all parameters/settings are set, press **Start Device** to program and begin recording data.

Device Menu: Stop Device

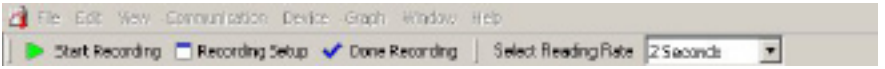
Select **Stop Device** from the **Device Menu** permits the software to communicate with the data logger and stop it from taking additional measurements. The data logger will enter a low power state to conserve battery life and when the memory is full. When full, the data recorder will stop recording additional readings and place itself into a low power state to maximize battery life automatically, this is simply a convenient way to extend the life of the battery. This mode is obvious to the user because the device will immediately wake up when the host computer communicates with the logger. When the device will not be used for a long period of time, stopping the device from collecting more data will conserve power to extend battery life. Stopping the device has no effect on the data in memory, the data is always retained.

Device Menu: Reset Device

Select **Reset Device** from the **Device Menu** to permit the software to communicate with the data logger device, and stop it from taking further measurements. ***This will also erase all readings currently stored in memory.*** Resetting the device will cause the data logger to enter a low power state to conserve battery life.

Device Menu: Real Time Chart Recording

The **Real Time Chart Recording** command provides a graphical method for acquiring and viewing data in real time. Choose the **Real Time Chart Recording** command to select the menu items and toolbar to appear as shown below:



A logger must be connected to the interface cable to select and use the following features: reading rate, setup real time recording parameters, and start and stop the real time graphing.

Note: Data is not stored internally in the data logger while in Real Time Recording mode.

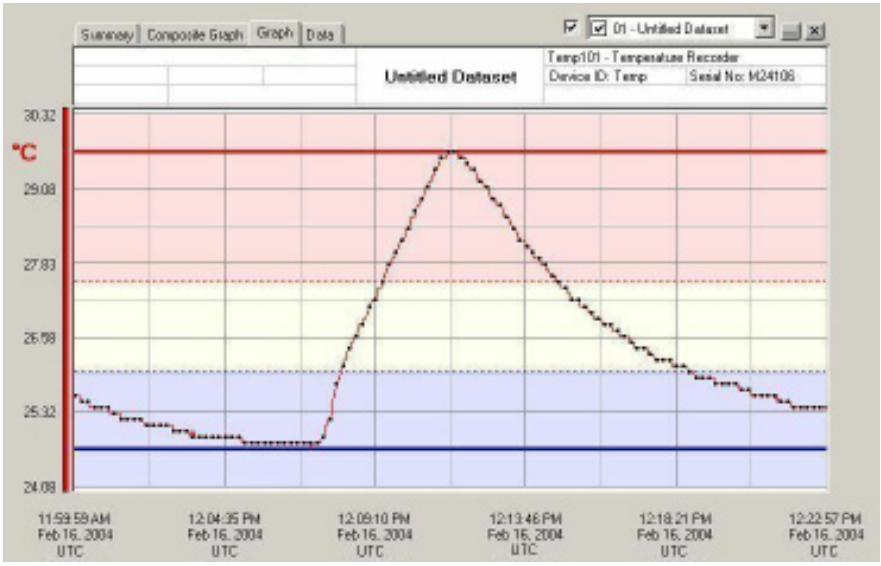
Start Recording

Select the **Start Recording** button to take a reading from the logger and update the screen at the selected reading rate.

Done Recording

Select the **Done Recording** button to discontinue recording from the logger.

An example of a real-time graph, using a Temp101 temperature logger:

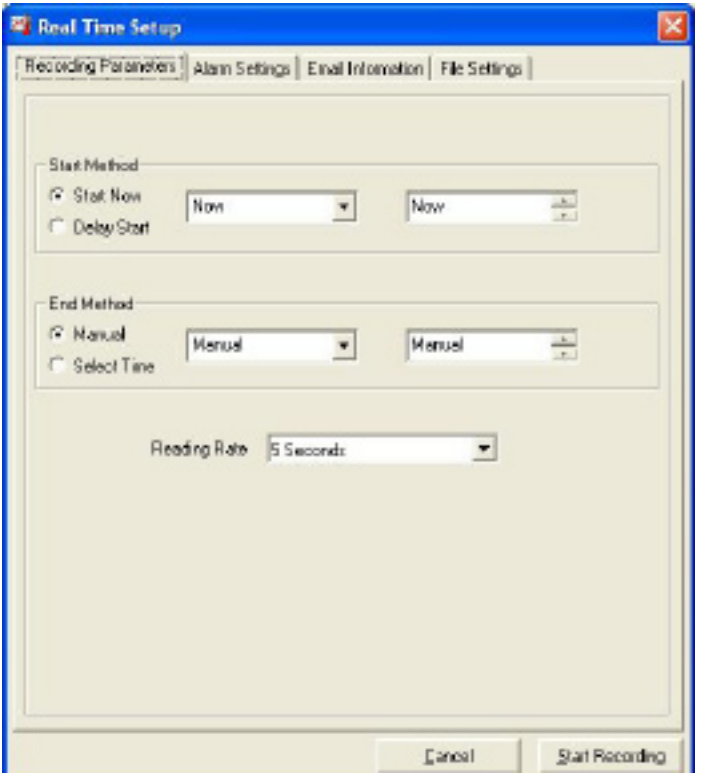


Note: The pink area is the warning area for high alarm setting of the data logger, the light blue area is the warning area for low alarm setting of the data logger if it has alarm the setting feature.

When the data has been accumulated in real time it can be saved and viewed in the same method as data that has been downloaded from a device. The data can also be viewed in tabular format while in the real time mode. Switching back and forth from a graphical to a tabular format is easily done. While in the real time recording mode, access to most software commands is restricted to eliminate interference with data collection. All windows except for the current window are inactive during data collection.

Real Time Setup

From the **Real Time Chart Recording** on the **Device Menu**, select the **Recording Setup Button**. This will display the following window:



Recording Parameters Tab

The **Recording Parameters** tab allows for set up of the recording start and end time.

Start Method: Start Now or Delay Start

Select Start Now to begin recording immediately or select **Delay Start** to delay the recording.

End Method: Manual or Select Time

There are two methods to end Real Time Recording:

1) manually
2) automatically

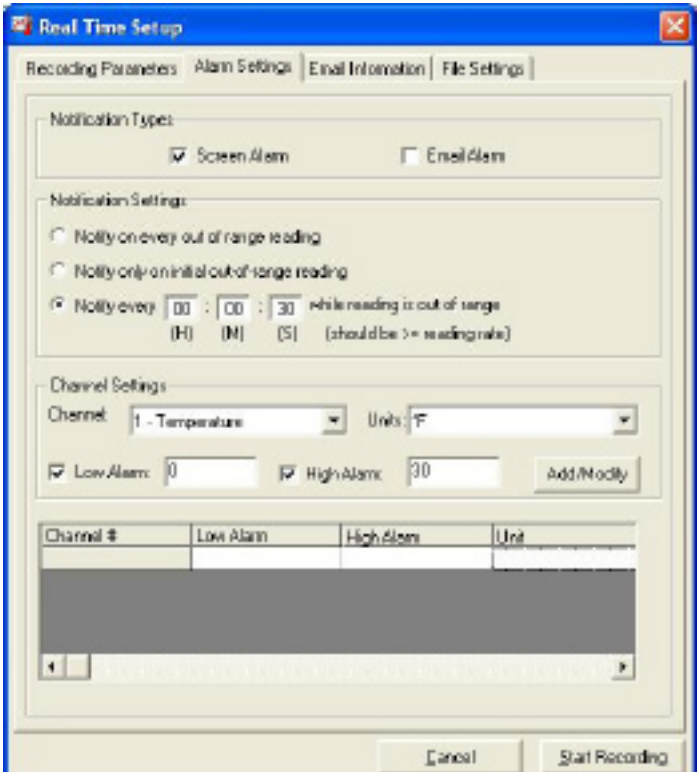
To end **Real Time Recording** manually select the **Done Recording** button on the **Real Time Chart Recording Toolbar**, page 70. To end automatically choose select time from the **Real Time Setup** screen, previous page.

Reading Rate

Select the Reading Rate from the dropdown list. To setup the **Real Time Recording** rate click the **Start Recording** button to start real time recording.

Alarm Settings Tab (software level)

The **Alarm Settings** tab selected in the screen below, allows the user to set up and receive alarm notification in two different ways, namely screen alarm and e-mail alarm.



There are three steps to setup the alarm:

1. Notification Types

- Check Screen Alarm box to show alarm information on the screen.
- Check Email Alarm box to receive an alarm warning message by email or by text messaging.

2. Notification Settings

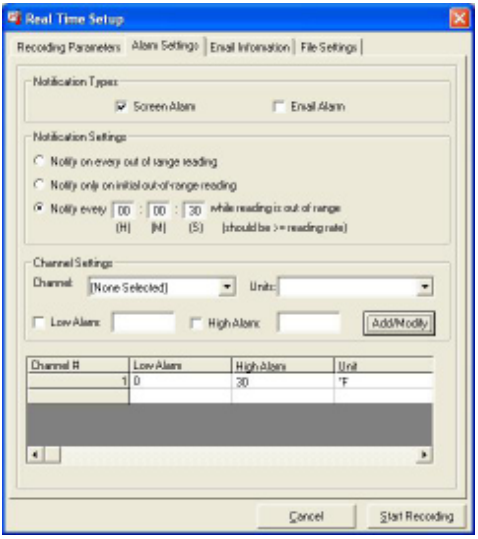
To receive an alarm warning message for every reading that is outside of the programmed alarm range select the notify every out of range reading option to receive an alarm.

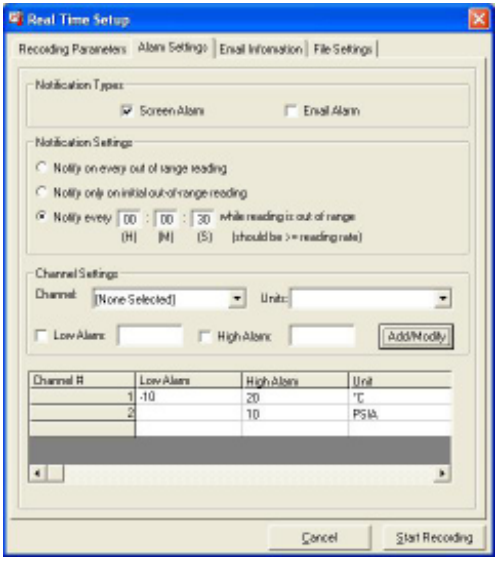
To receive an alarm warning message only once when the first time the alarm range is out of the alarm setting, select the notify only on initial out-of-range reading option.

The alarm warning message can be received at certain time intervals when the alarm range is out of the alarm setting. To enter the interval time desired use the notify every XX:XX:XX while reading is out of range

3. Channel Settings

Select the channel and then the unit for the channel by clicking the Channel and Units dropdown boxes, respectively. It will affect the graph's unit on the screen, but not the unit preferences. Check the Low Alarm and/or High Alarm boxes and enter a low alarm value and/or a high alarm value for the selected channel and unit. Click the "Add/Modify" button, and the low and/or high alarm will be populated in the grid.



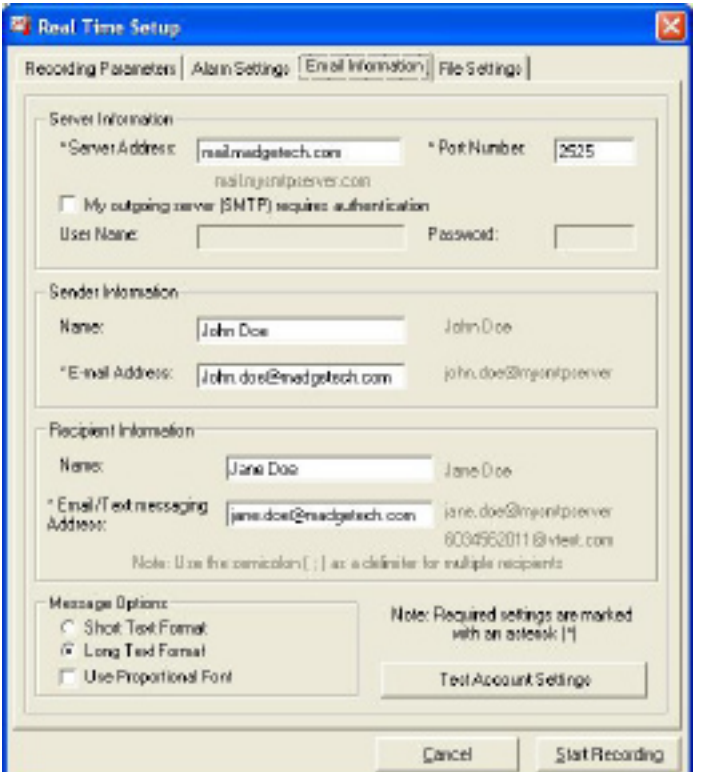


Multiple channel alarms can be set.

The screen alarm notification window.

Email Information Tab

Use the **Email Information** tab to set up email information. Fill in required fields with the correct information. Select the **Test Account Settings** button to confirm the settings work correctly.



Message Options

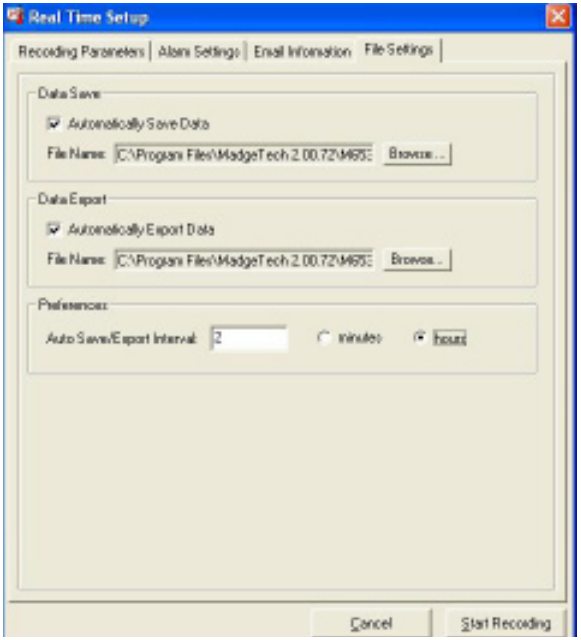
The **Long Text Format** and **Short Text Format** permit alarm notification by email. The **Short Text Format** is typically used for text messaging systems such as Cell Phone.

The **Use Proportional Font** option relates to the font output of the data. When checked, fonts will be sent in a proportional font, e.g. Times New Roman. When unchecked, fonts will be sent in a fixed width font, e.g. Courier.

Note: An internet connection must be enabled on the host computer for this feature to work. Please refer to the host computers Windows Operating Manual for specifications.

File Settings Tab

The **File Settings** tab is to manage files.



Data Save

The **Data Save** option allows data to be saved automatically and sets a save location for the **Real Time Recording Data**. See page 18 for **Save** file types.

Data Export

The **Data Export** option allows data to be exported automatically and sets a default export location for the **Real Time Recording Data**.

Preferences

The **Preferences** option allows the save and export features to occur automatically at set time intervals (see screen on previous page).

Device Menu: Display Real Time Wireless Data

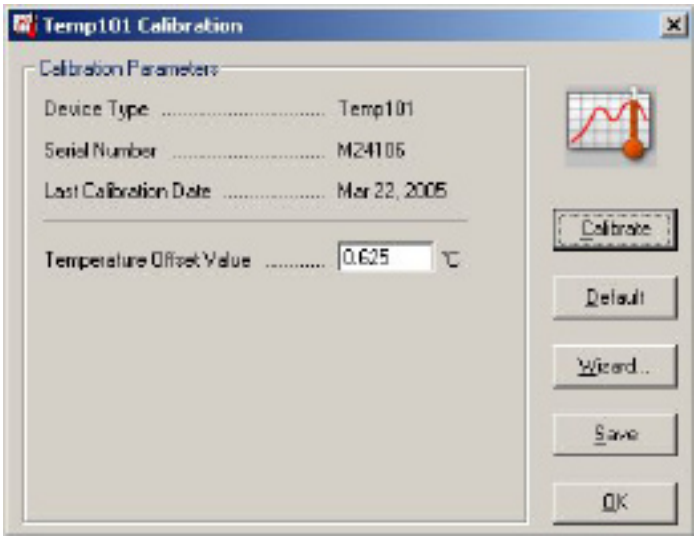
The **Display Real Time Wireless Data** command displays real time readings from RF series data loggers. The real-time data can be viewed in a graphical or tabular format, just like in **Real Time Chart Recording**. To accept RF readings, the computer must have an RFC101A interface cable connected to an available COM port, and the transmitter must be enabled to transmit.

Note: The RFC101A has a baud rate of 4800. The user must manually configure this baud rate. See* Communication Menu: Select Baud Rate*, page 45.

Device Menu: Calibration

Select **Calibration** from the **Device Menu** (see screen on following page). All data logger devices can be calibrated through the software. This eliminates the need for opening the device or adjusting potentiometers. Calibration parameters, as well as the last calibration date, are stored within the device itself in non-volatile memory. This can be accessed through the software. It also allows the device to maintain calibration while being used on any computer. Most data loggers can be effectively calibrated using a single point to correct an offset. In some cases, two points may used to correct for gain and offset errors. The Temp101 uses a single point calibration. The calibration offset is defined as the value the device reads at zero. Thus, if the Temp101 reads 0.5 °C when the correct value is 0 °C, the user would enter 0.5 °C for the calibration offset. The 0.5 °C would then be subtracted from each reading downloaded from the device, and the data would be correct without any further manipulation. The Temp101 **Calibration** window, shown on the next page, is displayed when the **Calibration** command is selected, and a Temp101 is connected to the interface cable. To edit the calibration values, click on the **Calibrate** button. The **Default** button may be used to return all values to their default settings (0.000 for offset values, and 1.000 for gain values.)

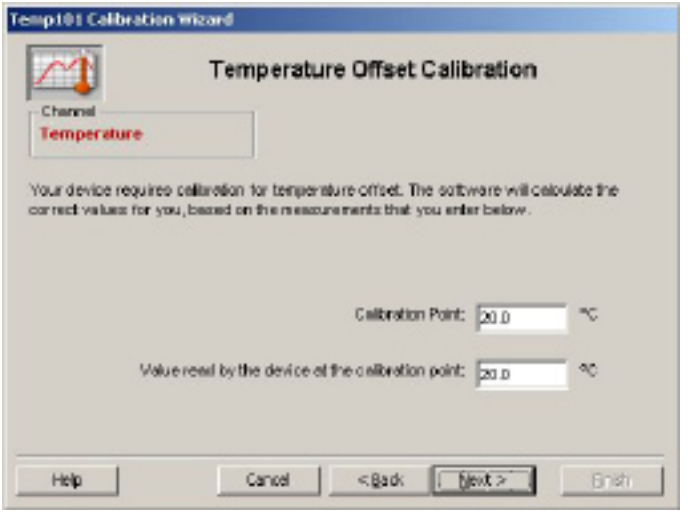
Sample Calibration Screen



For convenience, a **Wizard** button is available. Select this button to display the **Calibration Wizard**, a series of screens with fields can be fill in regarding the behavior of the ***un-calibrated*** (all values set to the default) device. The wizard performs the calculations for the offset and/or gain values and puts them into the correct fields in the calibration window. To commit to any changes, select **Save** to store the calibration information in the device. The calibration is then saved, and the new calibration values are displayed.

The Calibration Wizard

The **Calibration Wizard** displays information which correlates to the type of device attached. The following screen is an example of a Temperature Gain/Offset calibration on the Temperature channel of a Temp101 device. To calibrate the device select the **Next** button, complete the required fields for each channel of the device, and select the **Next** button again until the **Wizard** highlights the finished button. Select the **Finish** button and the calculations are made and the correct values are placed into the **Calibration** windows. Select **Save** to save these values into the device.



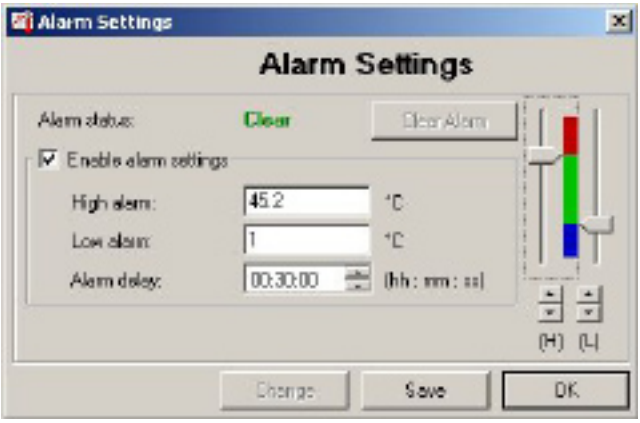
Device Menu: Alarm Settings

From the **Device Menu**, choose **Alarm Settings**. This command is only available when a data logger with this feature is connected.

This command allows the high and low temperature points to be set, also high and low warn temperature points can be set if the device has this feature, a visual alarm (flashing LED, the RED one indicates the exceed range of high and low alarm and the YELLOW one indicates the exceed range of high and low alarm warn) will be triggered. If the device has the time delay feature, the time delay can be set to trigger a visual alarm. These points should be set in the units indicated.

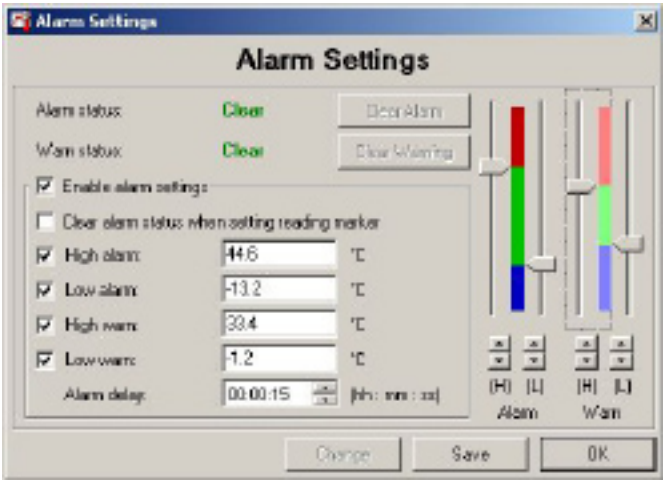
Without Alarm Delay

Without Alarm Warn



With Alarm Delay

Without Alarm Warn



With Alarm Delay

With Alarm Warn

To edit these alarm values, select the **Change** button, as shown in the windows above.

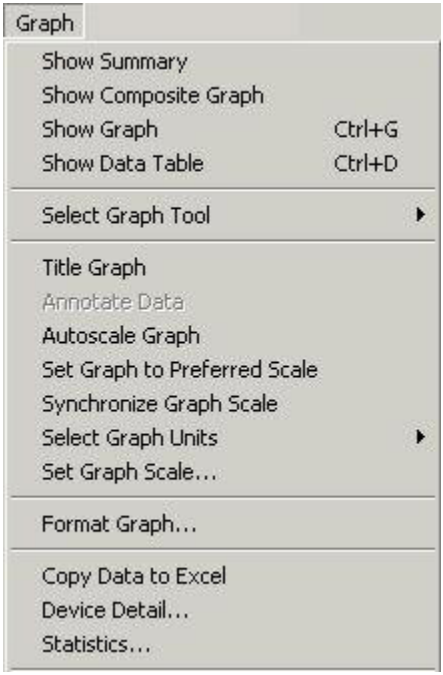
By default, the **Clear alarm status when setting reading marker** check box is unchecked. If it is checked, the user can press the push button of device to set the reading mark and clear alarm status (high and low alarm, high and low warn, and alarm delay) during the reading period.

Select **Save** to store the values into the device. When the alarm values are stored into the device, they are rounded to the nearest alarm set point for that device. Once the alarm has been tripped (e.g. the temperature has gone outside the set limits), the LED will flash at a one second reading rate until the device is reset or the alarm is deactivated by the Alarm Settings Disable command. It is important to remember that the device only takes readings at its programmed reading rate.

NOTE: If a temperature travels outside the set limits between readings, it will be missed by the device and the alarm will not become active.

Graph Menu

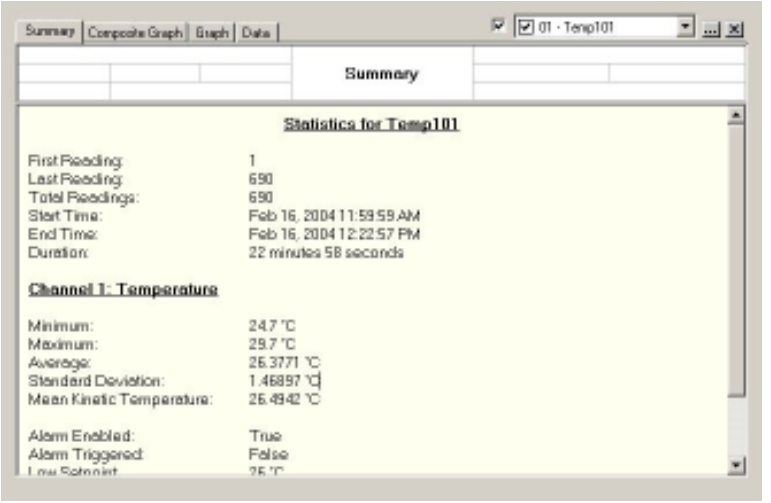
The **Graph Menu** appears like this:



Graph Menu: Show Summary

Select the **Show Summary** command from the **Graph Menu** to display the **Summary** tab, which will appear as follows on the next page:

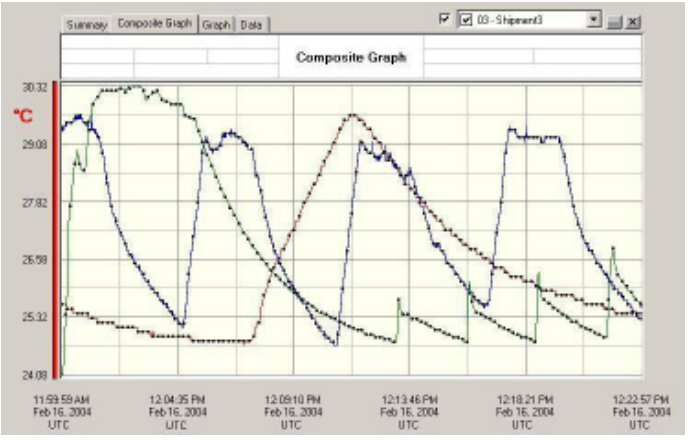
Sample Statistics for Temp101



Graph Menu: Show Composite Graph

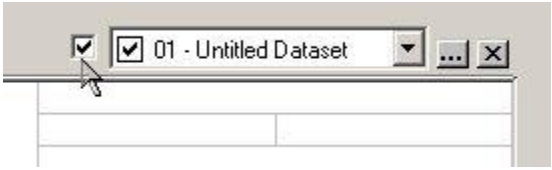
Select the **Show Composite Graph** command from the **Graph Menu** to display the **Composite Graph** tab, which will appear as follows:

Composite Graph Tab

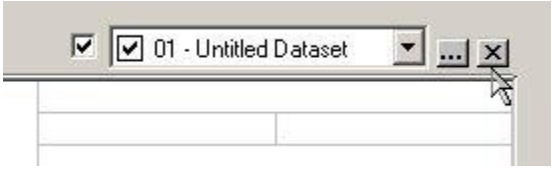


The **Composite** tab displays a graph of one or more datasets. Datasets can be loaded by using the **Open** command from **File Menu**, page 16. Once loaded, they are displayed as graphs.

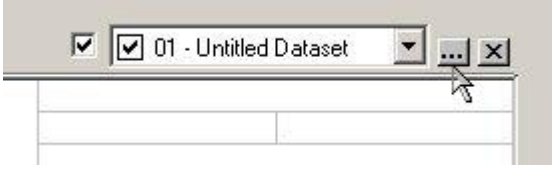
To display the dataset(s) select one from the dropdown list at the top-right corner of the composite graph (see below). Select the checkbox next to the list to select or deselect the dataset(s) for display. Deselecting the dataset(s) does not unload it , it remains in memory and can be reselected at any time.



To unload a dataset from the memory, select it from the dropdown list at the top-right corner of the composite graph. Select the **X** button on the right to unload the dataset (see below). Once a dataset is unloaded, it cannot be redisplayed without reloading it using the **Open** command from **File Menu**.



To manipulate multiple datasets simultaneously, select the ellipses (...) button in the middle to open Graph Configuration form (see next page).



Deselect Dataset

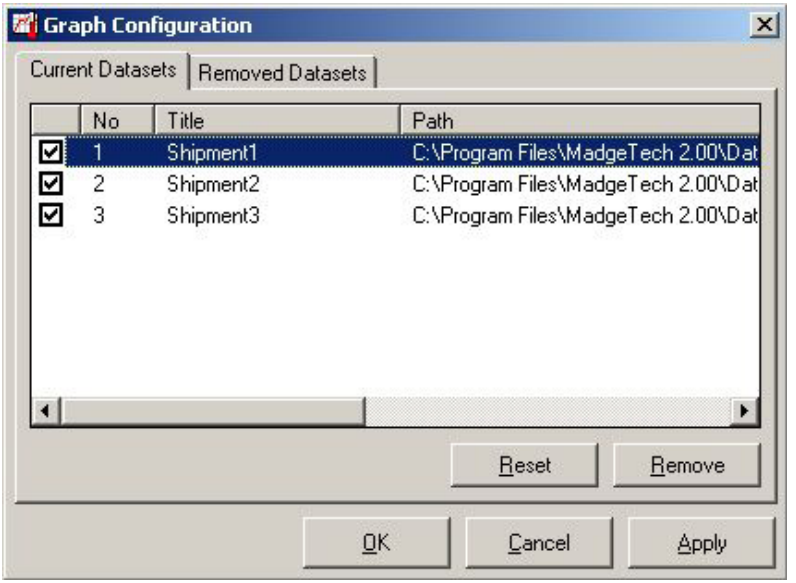
To **deselect dataset(s)** for display on the composite graph, uncheck them.

Unload Dataset

Highlight **dataset(s)** and press the **Remove** button to unload them from memory.

Unload Data Set into Temporary Buffer

Select the **Remove** button to place the unloaded dataset(s) in the temporary buffer, rather than unloading them permanently. They can be restored or reset. After selecting the **Apply** button or the **OK** button, the unloaded dataset(s) cannot be redisplayed without reloading them using the **Open** command from **File Menu**.



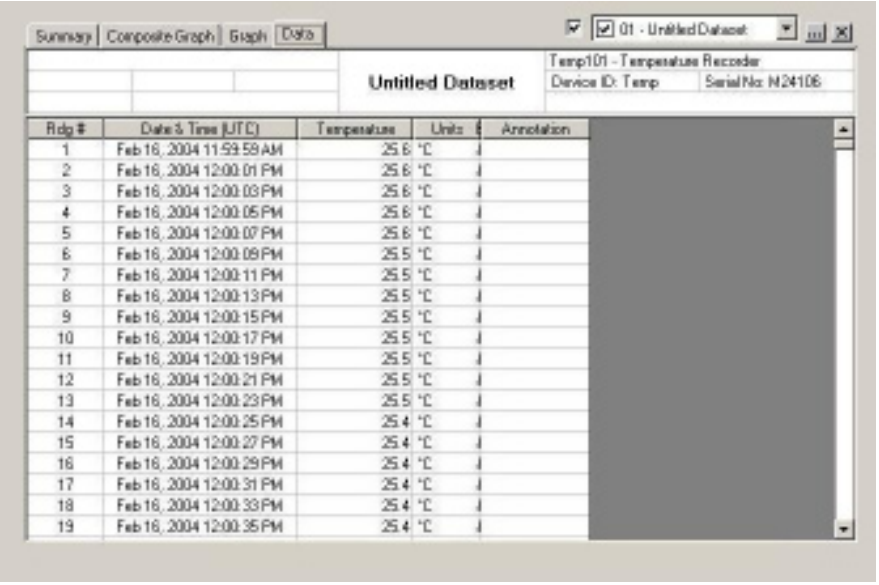
Graph Menu: Show Graph

Select the **Show Graph** command from the **Graph Menu** to display the **Graph** tab. This tab is similar to the **Composite Graph** except that only one dataset can be displayed at a time.

Note: In order to save a dataset, it must be displayed in the Graph or Data tab.

Graph Menu: Show Data Table

Select the **Show Data Table** command from the **Graph Menu** to direct the software to display the **Data** tab as shown in the window on the following page.



Rdg #	Date & Time (UTC)	Temperature	Units	Annotation
1	Feb 16, 2004 11:59:59 AM	25.6	°C	
2	Feb 16, 2004 12:00:01 PM	25.6	°C	
3	Feb 16, 2004 12:00:03 PM	25.6	°C	
4	Feb 16, 2004 12:00:05 PM	25.6	°C	
5	Feb 16, 2004 12:00:07 PM	25.6	°C	
6	Feb 16, 2004 12:00:09 PM	25.5	°C	
7	Feb 16, 2004 12:00:11 PM	25.5	°C	
8	Feb 16, 2004 12:00:13 PM	25.5	°C	
9	Feb 16, 2004 12:00:15 PM	25.5	°C	
10	Feb 16, 2004 12:00:17 PM	25.5	°C	
11	Feb 16, 2004 12:00:19 PM	25.5	°C	
12	Feb 16, 2004 12:00:21 PM	25.5	°C	
13	Feb 16, 2004 12:00:23 PM	25.5	°C	
14	Feb 16, 2004 12:00:25 PM	25.4	°C	
15	Feb 16, 2004 12:00:27 PM	25.4	°C	
16	Feb 16, 2004 12:00:29 PM	25.4	°C	
17	Feb 16, 2004 12:00:31 PM	25.4	°C	
18	Feb 16, 2004 12:00:33 PM	25.4	°C	
19	Feb 16, 2004 12:00:35 PM	25.4	°C	

Data Tab

The **Data** tab displays data in table format, to easily determine the exact value of each data point.

Graph Menu: Select Graph Tool

Select the **Select Graph Tool** command from the **Graph Menu** to enable the cursor mode which the mouse will assume when it is pointed and clicked over the graph. Several cursor modes are available, each with a specific function as follows:

Cursor

When the cursor mode is selected:

1. Click on a data point of the graph to indicate the value.
2. Click on or near a data point on the graph to indicate the value of the data point.

The data point selected can be changed by navigating the cursor or;

A. Use clicking method.

B. Click and drag the mouse horizontally in the graph.

C. Use the arrow keys (left, right) on the keyboard.

Time Cursor

When this cursor mode is selected, choose one of the following methods;

1. Click and drag the mouse horizontally over the graph area or
2. Use the arrow keys (left, right) on the keyboard, to indicate the time and value of each data point the cursor passes over.

Scroll

Select the cursor mode to scroll the graph in any direction to view a particular section. To scroll the graph, click and hold the mouse button, then drag the mouse in the direction desired. When dragging the cursor a line with an arrow is drawn to indicate the direction and amount of the scrolling operation. When the mouse button is released, the graph is then scrolled in the direction and by the amount specified.

Zoom In

When this cursor mode is selected, click on the graph to **zoom in** for a close-up view of a particular area of the graph. Multiple zooms may be performed to obtain best view. The software can only zoom in to a limited extent. If the zoom limit is reached, the following message will be displayed.

Message Box 1: Warning for Zoom In

Zoom Out

When this cursor mode is selected, click on the graph to **zoom out** for an overall view of a particular area of the graph. Multiple zooms may be performed to obtain the best view. The software can only zoom out to a limited extent. If the zoom limit is reached, the following message will be displayed.

Message Box 2: Warning for Zoom Out

Box Zoom

Select the cursor mode, then click and drag on the graph to draw a rectangle. When the mouse button, is released the graph will **zoom in** to obtain a close-up view of that area of the graph.

Horizontal Zoom

Select the cursor mode, then click and drag on the graph to draw a horizontal rectangle. When the mouse button is released, the graph will **zoom in** to get a close-up view of that area of the graph.

Vertical Zoom

Select the cursor mode, then click and drag on the graph will draw a vertical rectangle. When the user releases the mouse button, the graph will **zoom in** to get a close-up view of that area of the graph.

Cancel Zoom

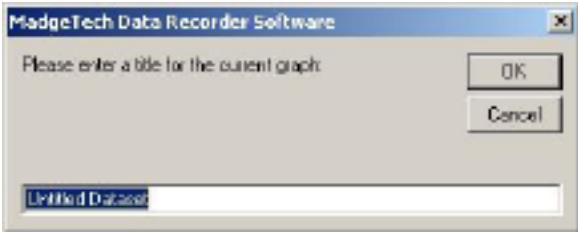
Select **Cancel Zoom** to cancel any zoom modes. The graph will be redrawn in its default state.

Graph Menu: Title Graph

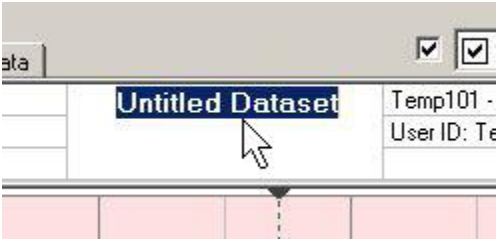
This feature will be disabled when no dataset is displayed on the screen. Otherwise, there are two ways to modify the title graph.

1. The title graph can be modified by selecting **Title Graph** from the **Graph Menu** (page 83) or The **Right Click Pop-Up Menu** (page 101).

The following screen will appear:



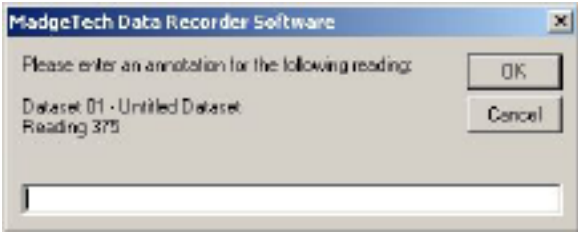
2. Double click the graph title area, to highlight and modify it.



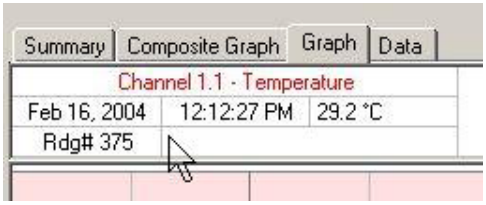
Graph Menu: Annotate Data

This feature will be disabled if there is no channel selected. Otherwise, there are two ways to annotate data.

1. Select **Annotate Data** from the **Graph Menu** or right click the **Pop-Up Menu**. The following screen will appear:



2. Double click the annotate data area on the heading of the graph. Type the annotation in the box as shown below:



Graph Menu: Autoscale Graph

Select the **Autoscale Graph** command from the **Graph Menu** to optimize the vertical scale of the graph to match the minimum and maximum data points shown on the graph. This provides maximum resolution for viewing the graph.

Graph Menu: Set Graph to Preferred Scale

Select the **Set Graph to Preferred Scale** command from the **Graph Menu** to set the graph to the preferred scale.

If no preferences are set, the graph will show on the vertical scale, the measurement range of the device (this may differ from the rated operating range shown on the label of the device). The time scale will begin when the first reading was taken, and end when last reading was taken.

Graph Menu: Synchronize Graph Scale

Select the **Synchronize Graph Scale** command from the **Graph Menu** to synchronize the time and value axes of the graph.

Graph Menu: Select Graph Units

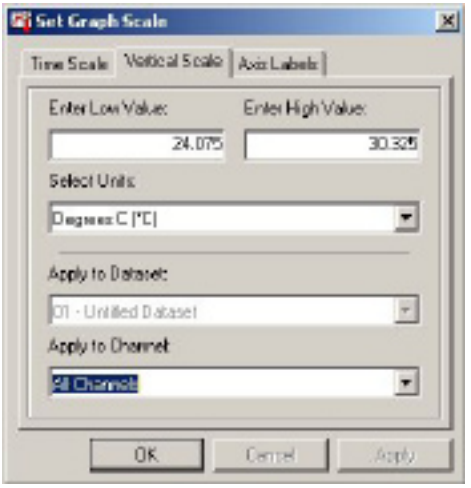
Select the **Select Graph Units** command from the **Graph Menu** to select the units to be used when displaying the graph. The available units will vary depending on the type of data logger used. For example, the Temp101 reads temperature and provides units of degrees Celsius (°C), Fahrenheit (°F), Rankin (°R) or Kelvin (K). The RHTemp101 records temperature and humidity and has available °C, °F, °R, and K for the temperature reading, and %RH, Dew Point and Water Vapor Concentration for the humidity reading.

Graph Menu: Set Graph Scale

Select the **Set Graph Scale** command from the **Graph Menu** to manually change and specify the values of the vertical and horizontal axis. The following three screens are shown for each of the tabs:

Time Tab

Scale Tab



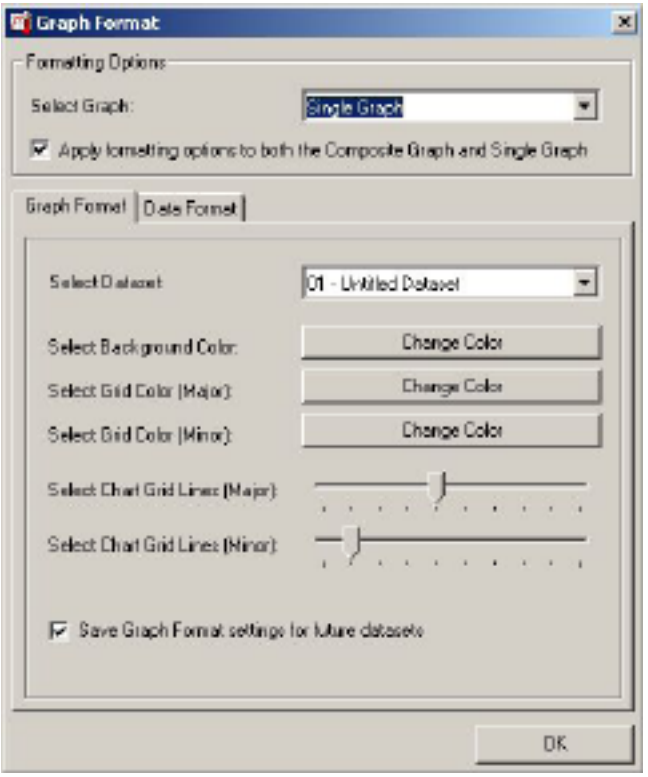
Note: In order to enter the low value or the high value of the unit a unit from the Select Units dropdown list box must be selected first. There is no unit selected if the value of the Select Units dropdown list box is No Units Selected.

Axis Tab

Different data recorders will show a slightly different window depending on the number of channels and the parameters being recorded. Scaling of the horizontal axis is controlled by the **Select Time Range** section. To set the end points of the horizontal axis, select the specified endpoints from the dropdown date and time selectors. The vertical axis is set using the **Vertical Scale** tab.

Graph Menu: Format Graph

Select the **Format Graph** command from the **Graph Menu** to display the following window:

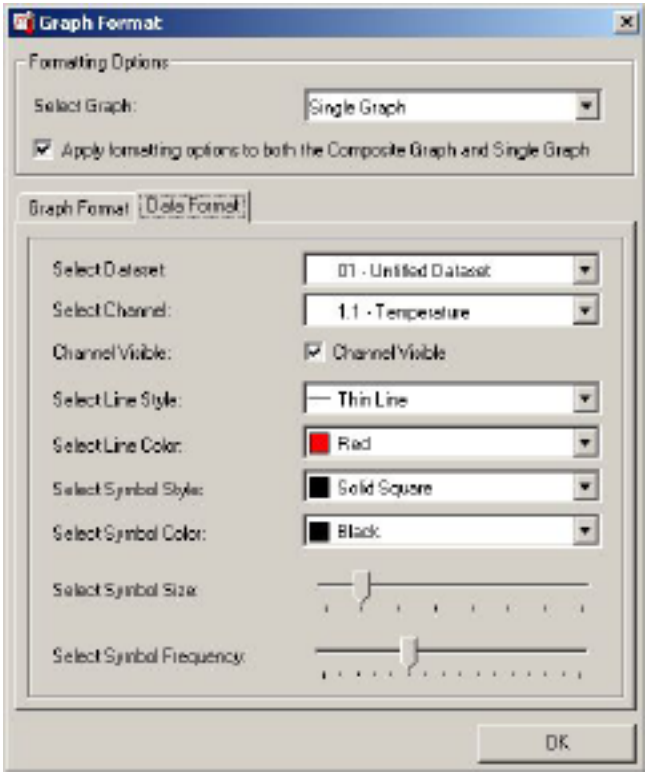


Edit **Formatting Option**s to apply formatting to the single graph, the composite graph, or both.

Graph Format Tab

Select the **Graph Format** tab to set the background color for the entire graph, as well as the color and number of the major and minor grid lines. Changes are applied to the dataset selected at the top of the frame.

The **Data Format** looks like this:



Data Format Tab

This window allows the user to customize the look of the graphical data for each dataset. First, select the dataset to customize from the dropdown list. Choose the channel from the second dropdown list (some devices have multiple channels). Then, select the thickness of the line, line color, symbol style, and symbol color from the remaining dropdown lists. Finally, select the symbol size and frequency (see **Manipulate Plotting Symbol**, next page) and whether the channel should be visible or not (see **Hide Selected Channel** and **Show Hidden Channels**, next page).

Manipulate Plotting Symbol

The **Select Symbol Size** slider and the **Select Symbol Frequency** slider are used to manipulate the plotting symbols. The zero setting removes all plotting symbols, and higher settings will approximately double the number of symbols on the graph as the slider is moved up one notch.

Hide Selected Channel

Uncheck the **Channel Visible** option to hide the selected channel or choose The **Right Click Pop-Up Menu** (page 101) to hide the selected channel.

Show Hidden Channels

Check the **Channel Visible** option to show the hidden channel. Click OK, the graph will be immediately redrawn with the option chosen. Choose the **Right Click Pop-Up Menu** to show the hidden channel also.

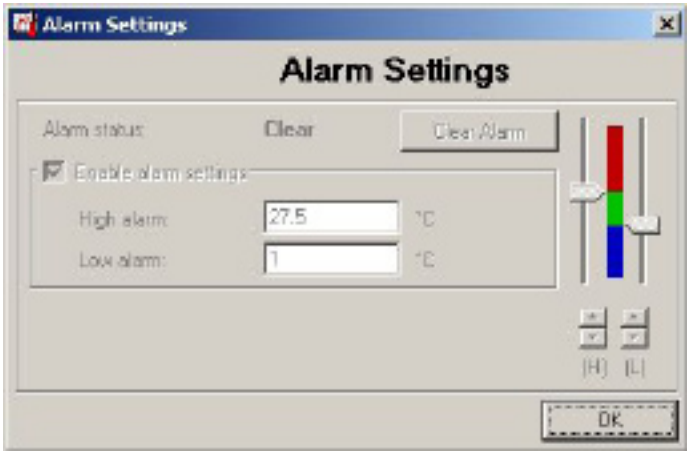
Graph Menu: Copy Data To Excel®

Select **Copy Data To Excel®** to allow the software to launch the Microsoft Excel® spreadsheet program, and copy the current dataset to an Excel® worksheet. This command will only work with a compatible version of Excel® properly installed on the host computer.

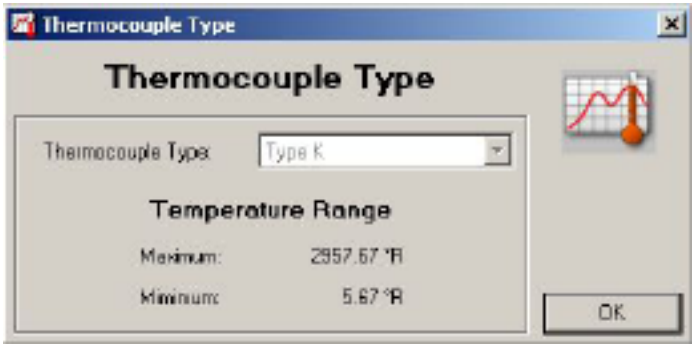
Graph Menu: Device Detail

Select the **Device Detail** command to display the device details of the selected dataset. This will include device type, revision number, subtype, and channel information. Information about alarm setting, thermocouple type, wireless configuration, wrap around and engineering units may also be displayed if the device supports those features. The window is similar to **Identify Device and Read Status** features, page 49.

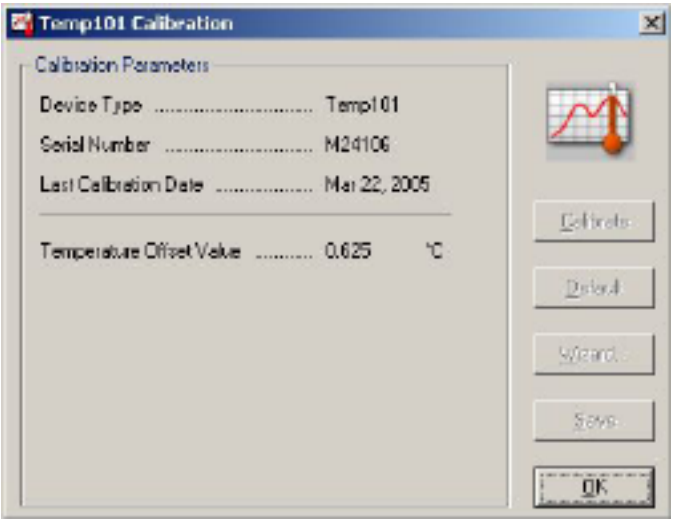
Select the **Alarm Setting** button from the **Device Detail** tab to display a read-only alarm setting screen to show the alarm range. This command is only available when the selected dataset is generated from a device that has this feature.



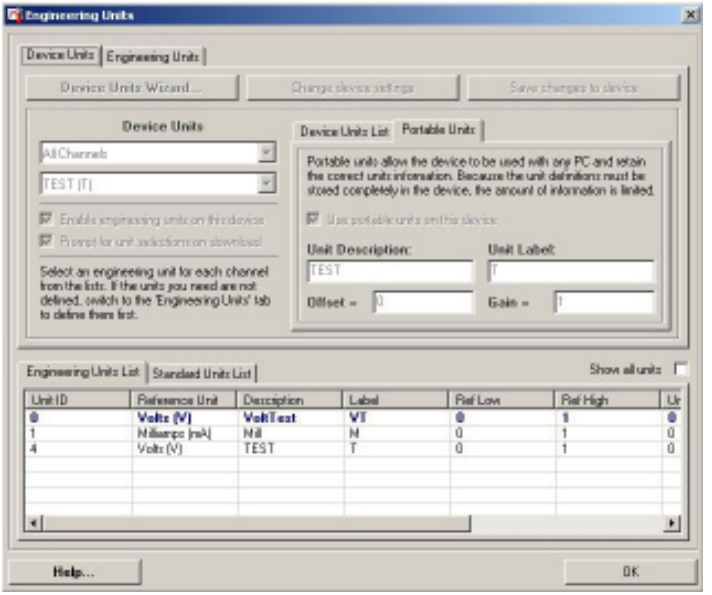
Select **Thermocouple Type** button from the **Device Detail** tab to display a read-only thermocouple type screen. This command is only available when the selected dataset is generated from a device that has this feature.



Select **Calibration** button from the **Device Detail** tab to display a read-only calibration form that shows the user the device of the selected dataset calibration information.



Select the **Engineering Units** button from the **Device Detail** tab to display a read-only engineering units screen. This command is only available when the selected dataset is generated from a device that has this feature.

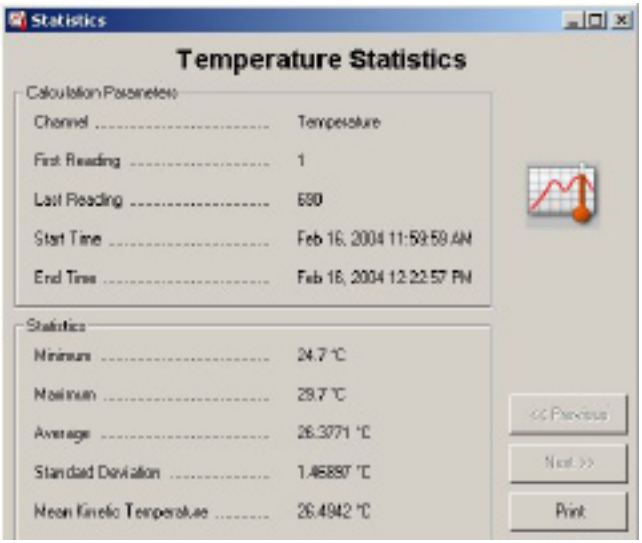


Trigger Settings

Select **Trigger Settings** to display a read only trigger setting screen. See page 59 for full operating instructions.

Graph Menu: Statistics

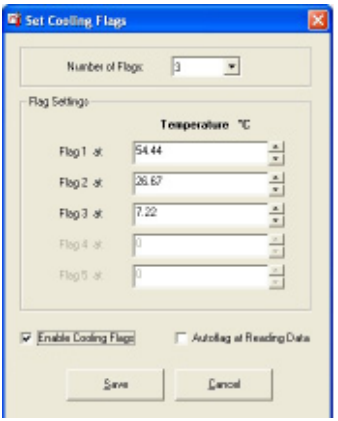
Select the **Statistics** command to calculate some basic statistics for data on each individual channel. A typical screen for some calculated statistics for the temperature channel of a Temp101 might appear as follows:



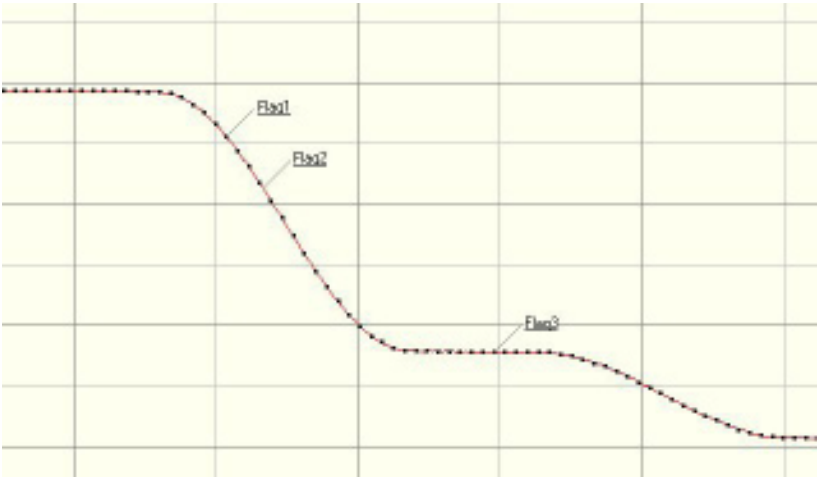
For data recorders with more than one channel, the **Next** and **Previous** buttons will be available. This allows the user to quickly view the statistics on each channel. In the example for the RHTemp101, activating the **Next** button will update the dialog box with the statistics for the humidity channel.

Graph Menu: Set Cooling Flags

Select the Set Cooling Flags command to allow the user to set the cooling flags on the temperature channel of the selected dataset. Checking the "Enable Cooling Flags" checkbox enables the Flag Settings to be entered. When the "Autoflag at Reading Data" checkbox is checked and the Save button is clicked, cooling flags will be drawn automatically the next time data is read.



A typical screen for setting the cooling flags for the temperature channel of a Temp101 might appear as follows:



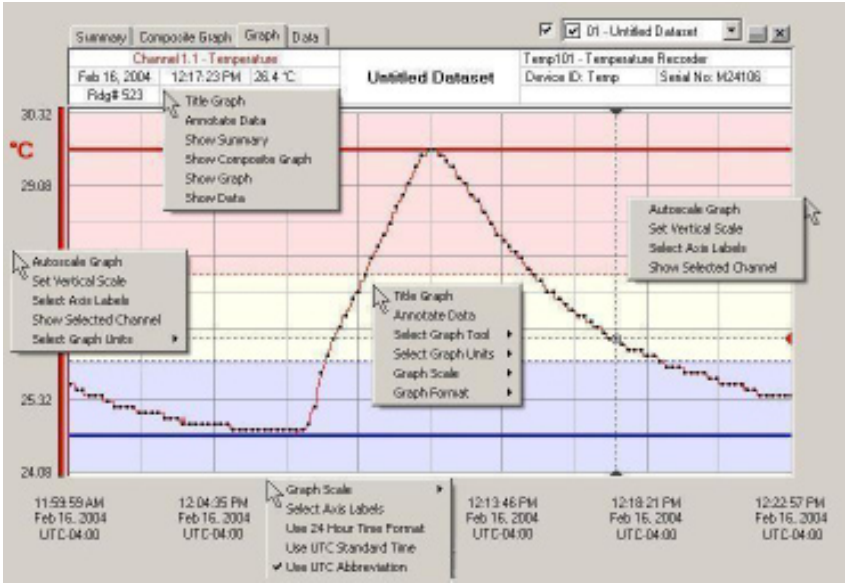
NOTE: In order to set the cooling flags, the selected dataset must be displayed in the Graph tab and have at least one visible temperature channel.

The Right Click Pop-Up Menu

The **Right Click Pop-Up Menu** incorporates menus from the **Graph Menu**. It provides a convenient way to manipulate the graph. It will show different pop-up menus depending on the position of the mouse on the screen.

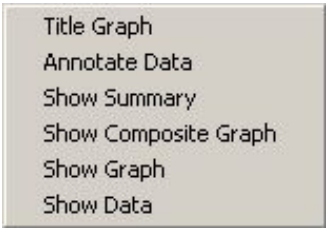
The **Right Click Pop-up Menu** will appear one of two ways (see page 105).

Window #1:



Submenu A

Click the **Title Graph** submenu to modify the title graph. See **Title Graph**, page 90.



Click the **Annotate Data** submenu to modify the Annotate Data. See **Annotate Data**, page 91.

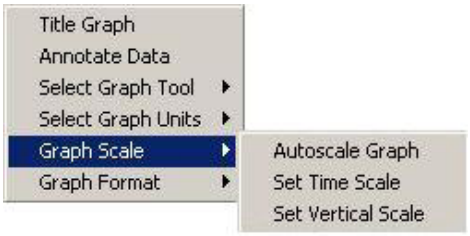
Click the **Show Summary**, **Show Composite Graph**, **Show Graph**, and **Show Data** options to bring up the **Summary**, **Composite Graph**, **Graph**, and **Data** tabs, respectively.

Submenu B

Highlight **Select Graph Tool** to change the cursor mode. See **Select Graph Tool**, page 87.

Highlight **Select Graph Units** to change the type of scaling units. See **Select Graph Units**, page 91.

Highlight **Graph Scale** to bring up the following box.

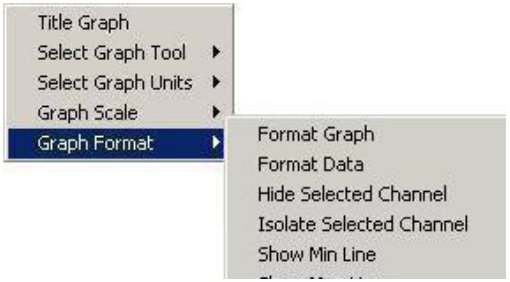


Click the **Autoscale Graph** option to automatically optimize the vertical scale of the graph. See **Autoscale Graph**, page 91.

Click the **Set Time Scale** submenu to display a time scale setting form. See **Set Graph Scale**, page 92.

Click the **Set Vertical Scale** submenu to display a vertical scale setting form. See **Set Graph Scale**, page 92.

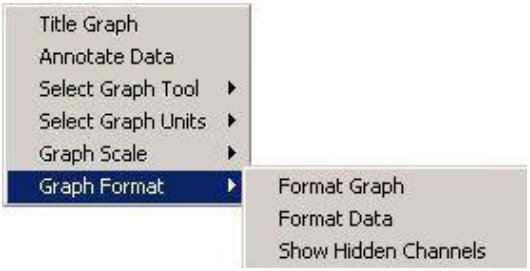
Highlight **Graph Format** to bring up the following box:



Click **Format Graph** to display a graphic format setting form . See **Format Graph**, page 94.

Click **Format Data** to display a data format setting form .

Click **Show Hidden Channels** to show all hidden channels in the graph.



The **Hide Selected Channel** is available when there is a channel selected on the screen. The **Hide Selected Channel** function, page 96 in the **Format Graph** menu, page 94 to hide the selected channel.

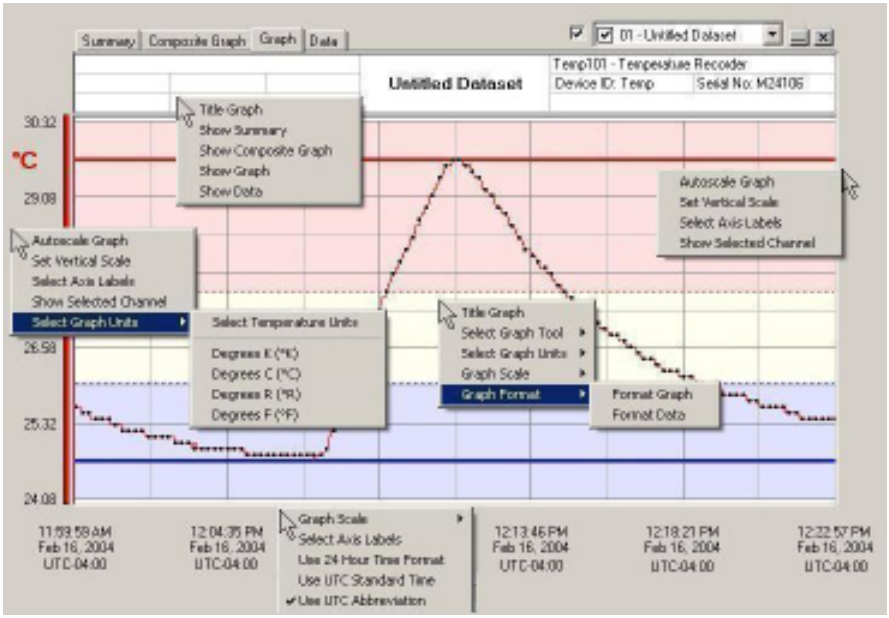
Submenu C

Click **Select Axis Labels** to bring up the **Set Graph Scale** box, under the Axis Labels tab. The user can choose which vertical labels are shown and whether they will be shown on the left or right sides.

Use 24 Hour Time Format, **Use UTC Standard Time**, or **Use UTC Abbreviation** to change the way the time is viewed. See **Display Preferences**, page 32.

Window #2

The **Right Click Pop-up Menu** will appear below if there is no channel selected on the screen by the user.

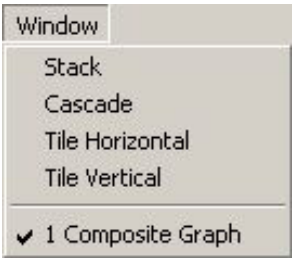


Here the **Right Click Pop-up Menu** is similar to Window #1 with two differences:

1. The submenu **Annotate Data** is not available.
2. The submenu **Hide Selected Channel** is not available in **Graph Format** menu.

Window Menu

The Window menu looks like this:



Window Menu: Stack

Choose **Stack** from the **Window Menu** to resize all the open graph windows to take up the whole main window and are to stack (overlay) on top of each other.

Window Menu: Cascade

Select **Cascade** from the **Window Menu** to resize all the open graph windows to a medium size, and then positions them in a staggered layer, one on top of the other, to maintain the title bars are visible.

Window Menu: Tile Horizontal

Select **Tile Horizontal** from the **Window Menu** to rearrange the open graph windows, to make fully visible and to align horizontally next to each other with no overlapping.

Window Menu: Tile Vertical

Select **Tile Vertical** from the **Window Menu** to rearrange the open graphs windows to make fully visible and to align vertically next to each other with no overlapping.

Window Menu: Selected File

When only one graph menu with multiple data sets is open, the line will show the selected tab that is open in the graph menu.

When multiple open graph menus are open with different data set(s) in each one, all the file names will be listed under this option. This method allows a desired graph to be viewed.

Help Menu

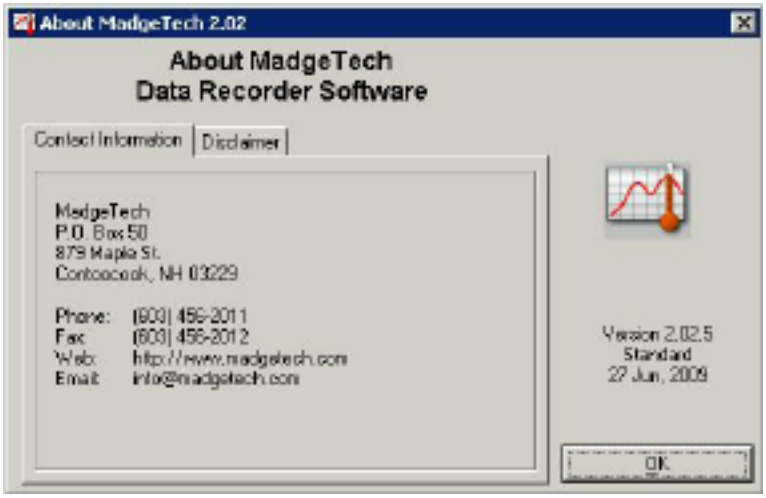
The Help Menu looks like this:

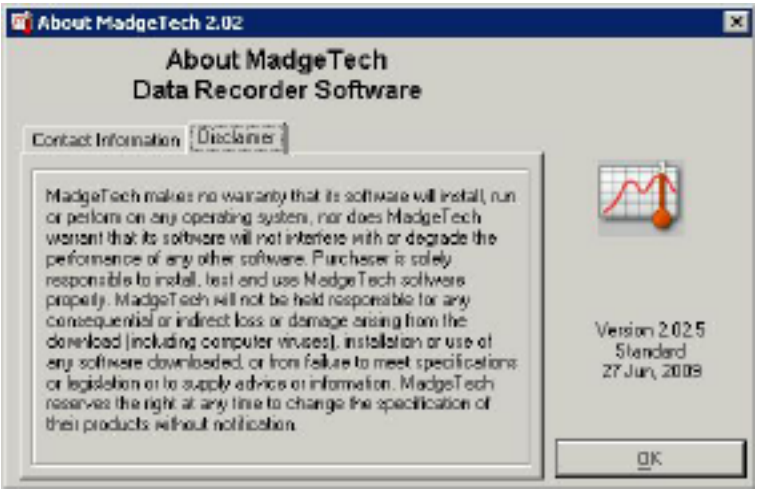
Help Menu: Contents

Select **Contents** from the **Help Menu** to bring up the **Help** window and display the **Table of Contents** for the online manual.

Help Menu: About

Select **About** from the **Help Menu** to bring up the **About** window and display information about the company and the software version. This screen includes the MadgeTech, Inc. address, phone number for technical information, e-mail address and web site. It also includes the full revision number of the software and the date of release.




About MadgeTech 2.02
About MadgeTech
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Version 2.02.5
Standard
27 Jun, 2009
OK

Help Menu: MadgeTech Website
Select **MadgeTech Website** from the **Help Menu** to bring up the MadgeTech Website for additional information.

Note: For this feature an internet connection and browser must be enabled on the host computer.

Wireless Series Devices

MadgeTech's RF series line of wireless-enabled data loggers provides a simple, low-cost wireless solution for short-range data collection applications. These products are powered by a user-replaceable internal battery and can be configured for up to ten years of battery life. They are designed for one-way, low data-rate applications, and transmit real-time data directly to a PC for monitoring. Like MadgeTech's standard series of data loggers, they are simple to use and their versatile configuration options allow for easy integration into a wide variety of applications. The product line includes models for all the most popular commercial and industrial measurements, as shown in this table:

PRODUCT	DESCRIPTION
RFTemp101A	Temperature Recorder and Wireless Transmitter
RFRHTemp101A	Humidity / Temperature Recorder and Wireless Transmitter
RFTC4000A	Thermocouple Temperature Recorder and Wireless Transmitter
RFRTDTemp101A	RTD Temperature Recorder and Wireless Transmitter
RFpHTemp101A	pH / Temperature Recorder and Wireless Transmitter
RFVolt101A	DC Voltage Recorder and Wireless Transmitter
RFProcess101A	DC Current Recorder and Wireless Transmitter
RFPulse101A	Pulse Recorder and Wireless Transmitter

These products have onboard memory in addition to the wireless transmitter, so they can completely replace existing data loggers and strip chart recorders while providing an added wireless data link. This memory can also serve as a failsafe backup, in the event of interference in the wireless channel or interruption of service to the monitoring computer.

Wireless: Transmitter Characteristics

The transmitter used in the RF series products is a carrier present-carrier absent (CPCA) amplitude-modulated (AM) signal operating at a carrier frequency of 418 MHz. The data being transmitted is encoded similarly to standard RS232 serial data at a bit rate of 4,800 baud. This signal is detected by the RFC101A receiver module and converted to RS232 signals, which are passed to the COM port of the monitoring PC.

The transmitter type and encoding method permit the device to use the maximum allowable output power specified by the FCC, and also minimizes the amount of battery power required for the transmission. This gives the user the best possible range, and also ensures a long battery life. To conform to FCC Part 15.231 rules, the data transmission takes less than one second and the minimum periodic transmission rate allowed by the device is 30 seconds. The low duty cycle permits several devices to use the same communication band and receiver without excessive interference caused by "talking over" each other.

Wireless: Transmission Distance

The transmission distance achievable with any wireless system is dependent on many factors. The only consistent measurement of transmission distance that can be used with these devices is called the "line-of-sight" transmission distance. The transmitter and receiver are set up in a large open area, free of obstacles and interference, and are aligned so their antennas are oriented in the same direction. Under these circumstances, the RF series products can achieve up to 120 feet (36 m) transmission range.

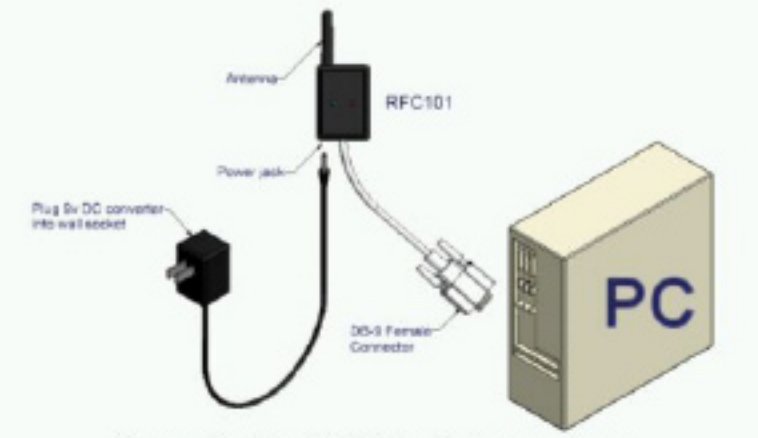
Wireless: System Components and Setup

The following components are required to successfully set up and use the RF series products:

- A personal computer running the Windows operating system (Windows 95 or higher)
- One of the RF series wireless-enabled data loggers
- An RFC101A wireless receiver module and power supply, for receiving wireless transmissions from the data logger
- An IFC110 interface cable, for communicating with the wireless data logger
- MadgeTech Data Recorder software, included with the RFC101A or IFC110

To configure the data logger, and register it on the PC for data reception, connect it to the PC through the IFC110 serial interface cable as shown in Interface Cable Installation

To set up the system for receiving wireless data, connect the RFC101A to the PC and plug in the power supply to a 110VAC outlet (as shown as below).

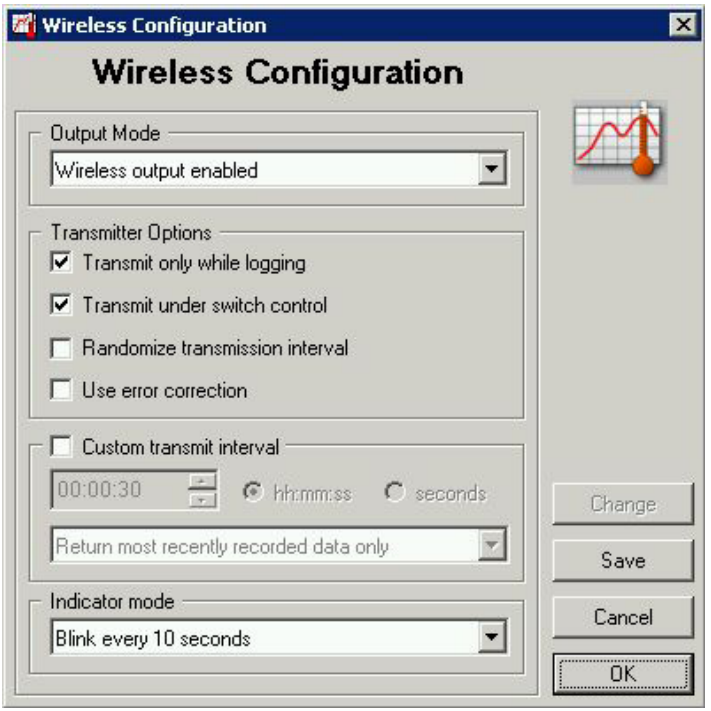


Connecting the RFC101A wireless receiver

In most cases, the IFC110 will need to be removed from the PC to connect the RFC101A. If there are multiple COM ports available on the PC, the RFC101A may be connected to a different COM port than the IFC110, thus leaving IFC110 connected. To switch between using the IFC110 and RFC101A, simply change to the appropriate COM port under the "Communications" menu.

Wireless: Wireless Configuration Dialog

The **Wireless Configuration Dialog** allows the user to select from a variety of operating modes to meet the requirements of different monitoring systems.



There are 2 ways To access this dialog

1. **Device menu** -> **Identify Device and Read Status** menu to open the **Device Status** window, switch to the **Device Detail** tab, and click the **Wireless Configuration** button.

2. **Device menu** -> Start Device and click the **Wireless Configuration** button.

To edit the configuration, press the **Change** button in the dialog, make the appropriate changes, then press the **Save** button to commit the changes to the device.

NOTE: Closing the dialog or exiting with the OK button will not store the changes in the device.

To comply with FCC regulations, saving a configuration change may cause the device to inhibit output from the transmitter while the internal timers synchronize to the new configuration (this may be the longer of the reading interval or custom transmit interval). To force synchronization of the timers and enable output before the aforementioned interval has passed, restart the device from the software.

Transmitter Output Modes

Real-time data transmissions may be sent through the RF antenna, the device's serial port, both or neither. If both the serial and RF transmitters are disabled, the device will function strictly as a standard data logger. The typical user will configure the device for wireless transmission only thus transmitting data from the device to the RFC101A receiver. However, serial transmission may be desirable for some systems where the built-in transmitter is not powerful enough to maintain a reliable link, the signal must be brought outside of an environment that blocks RF, or when a hardwired connection to an alternate transmitter is required. Additionally, both modes may be enabled for combined local and long-distance monitoring of the signal. See **Increasing Range with the RFExtender**, page 133.

Transmitter Options

The transmitter module has four configuration options. Two of these options pertain to enabling and disabling the transmitter under different operating conditions and two pertain to the timing and format of the transmitted signal. These options are summarized below.

1. **Transmit only while logging** – If this option is selected, the transmitter will only output data when the logger is recording data to memory. When memory is filled and the device stops logging, the transmitter will stop as well to indicate the logger needs to be offloaded and restarted. If the memory wrap-around mode of the logger is enabled, the device will continue to overwrite the oldest internal data and continue transmitting data wirelessly. If this transmitter option is not selected, the transmitter will continue to operate regardless of whether the device is recording data.

2. **Transmit under switch control** – If this option is selected, the on/off switch may be used to inhibit the transmitter output. This allows the user to manually stop the transmitter without affecting the logger operation or transmission timing. This may be useful for transporting the device through an area where other devices are operating on the same frequency band, disabling the transmitter until the device is placed in-system, or disabling individual devices to evaluate system performance and troubleshoot interference or collisions. In systems where a manual override is not desirable, this option may be left unchecked, and the transmitter will not be affected by the position of the switch.

NOTE: The above two transmitter options function as such: if either one of the modes would disable the transmitter under given conditions, the transmitter will be disabled. For the transmitter to be enabled, the required conditions must be met for both options to allow the transmission.

3. **Randomize transmit interval** – If this option is selected, the transmitter will wait a short random delay of up to 5 seconds before it transmits each data packet. This can decrease the chances of lost packets due to devices "talking over" each other because of long-term timer drift. Devices that are initially synchronized to transmit 10 seconds apart can drift in their time-keeping by up to 2 seconds per day, meaning that they could potentially interfere with each other after a few days of sustained operation. Because the transmission lasts less than a second, a random delay of up to 5 seconds can allow the majority of the transmissions to escape interference. If this transmitter option is not selected, the device will transmit at the interval set by its timer to within a few milliseconds. It is then up to the user to make any necessary accommodations for the timer drift. See **Using Multiple Devices** later in this manual.

4. **Use error correction** – If this option is selected, the transmitter output format will be modified to include a simple forward error correction scheme known as a Hamming code. This method of error correction allows the receiver in a one-way transmission to correct any single bit error in each block of eight data bits being received. This option may help to increase system reliability in some environments.

NOTE: System reliability will most commonly be degraded by loss of signal or by burst noise longer than a single bit, thus this option may not substantially improve performance for the typical user. Additionally, if this option is not selected, the device may be able to transmit two complete copies of the data packet, increasing the likelihood that one of the copies will be received even when the other is lost due to interference. (Each packet always contains error detection, to ensure that invalid data is not displayed.)

Custom Transmit Interval

By default, the transmitter module will transmit a data packet with each internally recorded data point, or if it is not recording, at the reading rate specified for the data logger. This option allows the user to specify a custom transmit interval that will be used only by the transmitter. Like the data logger reading rate, this interval is limited to a minimum of 30 seconds and a maximum of 12 hours, but unlike the reading rate it may be set to any multiple of 10 seconds. Additionally, the device can be configured to return new data every interval, or to repeatedly send the data from the most recent internally recorded reading. This option can be useful for the following reasons:

1. **Real-time monitoring** – Some applications may require relatively quick feedback of trend data to the user, but only need to be recorded at longer intervals. With this option, for example, an operator could check the trend of a system every 10 minutes and make necessary adjustments to keep the system within specifications, but the official logger record of the data only needs to indicate the value on an hourly basis.

2. **Increasing system reliability** – In applications where the operating environment is unfriendly to RF, this option can be used to repeat the same data multiple times to increase the probability of successful reception. If the logger is recording every 5 minutes, the transmitter can be configured to send the data from the last reading every 30 seconds, allowing for 10 transmissions per logger reading. If the environment sees a burst of RF interference a few times per minute, it is highly probable that one or more transmissions will be received properly.

3. **Staggering transmissions from multiple devices** – If several devices need to record data at the same time while transmitting the output in real time, this option can be used to ensure that at least one transmission from each device is sent without interference from the other devices. This is similar to the randomization option provided above, but is better suited to some applications. See “Using Multiple Devices” later in this manual. In the screenshot below, this particular wireless data logger is set to “delay start” at 1:00PM; since the sample interval is 30 seconds, the next data logger should be started at 1:00:30, and the next logger should be started at 1:01:00, and so on.

To prevent confusion, it's helpful to set a delay start time for the first logger that is on the hour, half hour, quarter hour, 10 minutes of, and 5 minutes of. For example:

- On the hour: 2:00PM, 3PM, etc.
- On the half hour: 2:30PM, 3:30PM, etc.
- On the quarter hour: 2:15PM, 3:15PM, etc.
- 10 minutes of: 2:50, 3:50, etc.
- 5 minutes of: 2:55, 3:55, etc.

To find the ideal delay start interval, use the following calculation:

To determine the reading rate, you must perform a simple calculation: X/Y=Z. To solve for the ideal reading rate (Z), divide X by Y.

(Desired Reading Rate(X)) / (# Of Loggers(Y)) = Ideal delay between loggers (Z)

Example:

(15 minutes X 60 seconds)/25 = 36. It is best to use the closest odd number, so a 37 second delay start interval will be used.

NOTE: Rounding up is not encouraged because it can increase the chances of data overlap.

- X= Desired reading rate (in seconds)
- Y= # of loggers
- Z=?

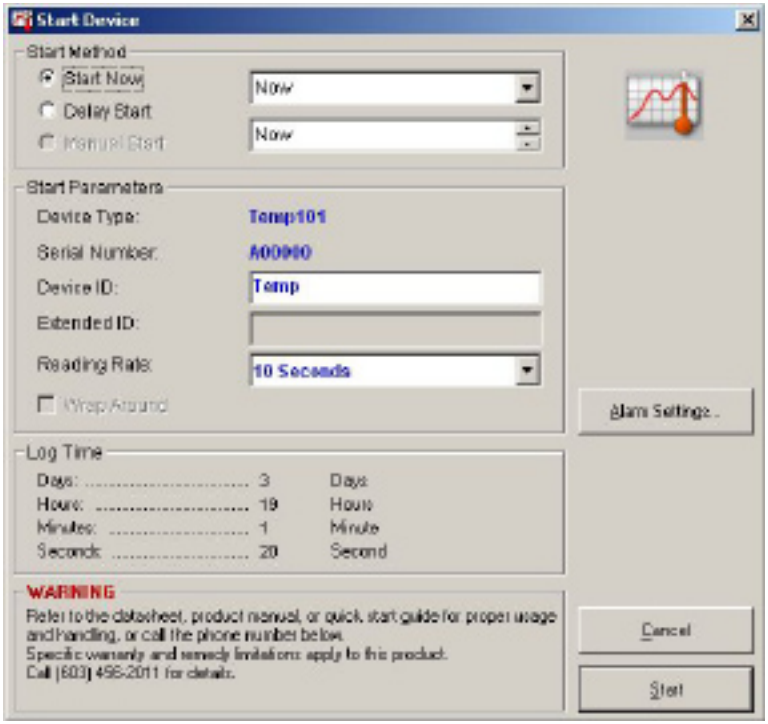
Example 1:

If X= 15 minutes, and Y= 25 loggers, then Z= 0.6 minutes X 60 seconds = 36. In this example, 36 is rounded to an odd number, such as 37; 37 seconds is the ideal delay start interval.

Example 2:

If X= 60 minutes, and Y = 75 loggers, then Z= 0.8 minutes X 60 seconds = 48. In this example, 48 is rounded to the nearest odd number, such as 49; 49 seconds is the ideal delay start interval.

NOTE: If Z results in < 30 seconds, change X and/or Y.



Indicator Mode

The device may be configured to blink the LED activity indicator every 10 seconds (the factory default setting) or only when a scheduled reading is taken. The green LED indicator will blink to indicate that the device is configured properly to allow a wireless transmission to occur. If the wireless transmitter is disabled by any of the available configuration options (by setting the transmitter output mode to disable the wireless output, or by selecting either of the related transmitter control options), the indicator will not blink. When a wireless transmission is about to be sent, both the green and the red LED indicators will blink.

The primary reason to turn off the 10-second indicator is to conserve battery capacity. See **Battery Life**, page 138. The 10-second mode is forced “on” if the custom transmit interval discussed above is enabled.

Wireless: Registering the Device on a System

Before the MadgeTech software will receive data from an RF-series transmitter, the device must be properly registered on the system. When the device is identified or configured, the PC software will store an image of the device for future reference. This image is stored on the PC's hard disk so it is retained even when the software or PC is shut down. The software then refers to the device image when receiving a transmission to "fill in" the information that is not transmitted in the data packet. This information includes the device ID, calibration date, and measurement variables such as a thermocouple type or engineering units. The data packet contains a checksum of critical settings to ensure invalid data is not displayed. For this reason, the device must be re-registered if it is calibrated or the measurement data is changed on another PC.

NOTE: that re-registering a device after a configuration change will not allow the PC to receive data from the transmitter if there is already data from the device in the wireless graph. If no data has been received since the software was launched, or the software is closed and launched again, the software will receive the transmissions as expected. This behavior is caused by the fact the data that has already been received is only valid with the previous image. Adding new data to the old dataset with different calibration constants or thermocouple type would result in invalid data.

Wireless: Starting the Device and Synchronizing the Transmitter

Like other MadgeTech data loggers, the RF series devices must be configured through a PC. The wireless transmitter is primarily set up through the **Wireless Configuration** dialog discussed previously, but synchronization of the transmitter to the desired starting time is accomplished through the **Start Device** dialog when launching the data logger. When launching, choose the start time, and set the logger parameters (device ID and reading rate) for the run. When the device is started, both the logger and transmitter time base will be set for the selected start time. They will remain inactive until the selected time, and then begin to operate as configured in the **Start Device** and **Wireless Configuration** dialogs. When the delay-start time arrives, the logger will take readings (if enabled) at the programmed reading rate, and wireless transmissions (if enabled) will be made at the reading rate or custom interval, depending on how the device is configured.

If a delayed start is specified, the device will remain completely inactive during the start delay period. The indicators will not blink, no readings will be taken and no transmissions will be sent. It will continue to communicate normally, and may be queried, stopped, or restarted. If the application only requires the wireless transmitter without data logging capability, the device may be stopped immediately (when the "Transmit only while logging" option is not selected) after launching without affecting the scheduled start of the wireless transmissions. This will marginally improve the battery life when data logging capability is not required.

If immediate start is specified, the device will begin logging immediately, but it will inhibit transmitter output for the first reading to comply with FCC regulations. To ensure the first transmission is sent, use the delayed start mode with a 1-2 minute delay (minimum allowed by software).

Once the device is started, the wireless transmissions can be viewed by performing the following steps:

1. Connect the RFC101A wireless receiver to a COM port (see Connecting the RFC101A wireless receiver of Wireless: System Components and Setup)

2. Go to the **Communications** -> **Select COM Port** menu and select the COM Port matching the port that the RFC101A is attached to (usually COM1)

3. Go to the **Communications** -> **Select Baud Rate** menu and select 4,800 Baud

4. Go to the **Communications** menu and ensure that **Accept Real Time Wireless Input** has a check mark next to it. If it does not, click on it and go back to the **Communications** menu to confirm it is now checked.

5. Go to the **Device Menu** and choose **Display Real Time Wireless Data**

6. Wait for the first data point to be received.

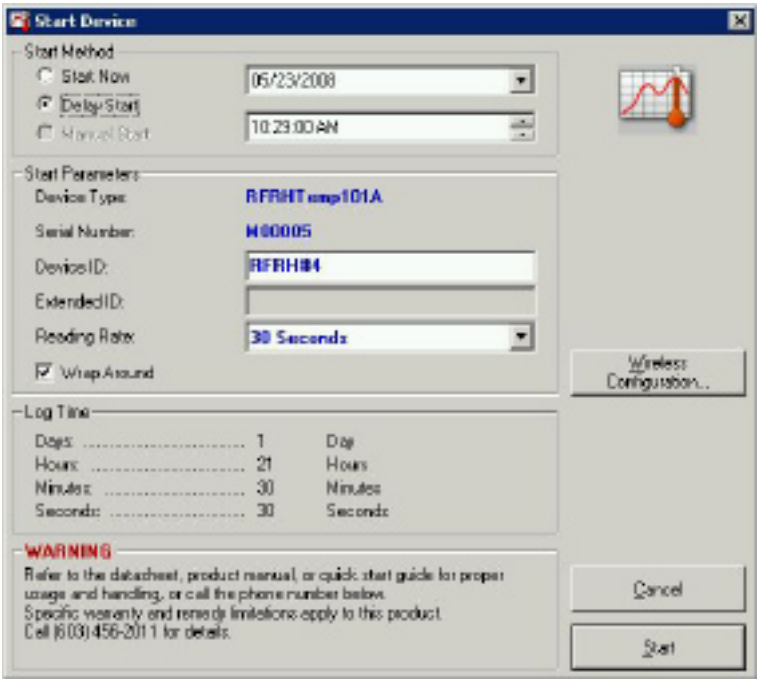
7. For multiple data loggers, choose the **Composite Graph** tab to view all of the wireless data sets in one graph. This helps the speed in refreshing the graph and is useful when comparing data from multiple data loggers, and looking for data trends.

The LED's on the RFC101A indicate power (green) and data (red). The Red LED light up briefly every time a new data point is received. The Green LED should be on steady. If not, ensure that the wall power adapter is plugged in properly.

Wireless: Using Multiple Devices

When using more than one RF transmitter, should transmissions overlap, it is certain that one or both of the transmissions will be lost. There are several methods, described below in order of complexity (least to most), to circumvent this issue:

1. Use Delay Start to Stagger the Reading / Transmit intervals – By choosing a reading rate (see below Table:Prime numbers from 3 to 2160 and Table:Prime number examples, or above Staggering transmissions from multiple devices under Custom Transmit Interval) and delay between start times on multiple loggers, you can ensure that the computer never receives more than one wireless signal in a 30 second window.



2. **Rely on the logged data** - The RF transmitters can be configured to log all data to non-volatile memory. If a data point is lost, it may be fully recovered by a later offload.

3. **Provide a direct connection** - If it is possible to have a PC always connected to the RF series logger (while monitoring via RF elsewhere), then using the serial output transmitter mode or the real-time chart recording feature of the software will avoid RF interference.

4. **Randomize the transmission interval** – This option is selected from the wireless configuration menu. Selecting this option will cause the transmitter to wait a short random delay of up to 5 seconds before it transmits each data packet. Should two transmitters drift to within 5 seconds of each other, this feature will reduce the dropped points by about 80% until the transmitter clocks drift apart again. This will also decrease the chances of sequential lost packets.

5. **Staggering of scheduled transmissions** – By starting the RF transmitters at different times, the transmissions will not overlap until the time drift between the transmitter clocks causes transmission collisions. At room temperature, the typical clock will drift no more than 1-2 seconds per day. Higher or lower temperatures will cause more drift. For example: if you use delay start to start one transmitter at 11:00:00 and a second transmitter at 11:00:30 (at 1 minute sample rates), then typically they would run for about 30 days (at similar temperatures) before there was a possibility of a collision. However, temperature fluctuations that deviate up or down from room temperature will generally cause the clock to run slower. Thus, potential collisions depend the time between samples, relative clock accuracy and relative ambient temperatures.

6. **Prime number scheduled transmissions** – This method utilizes prime numbers to help prevent transmission collisions. See the next section for further detail on this method.

Wireless: Preventing Collisions with Prime Numbers

As mentioned in the previous section, prime numbers can be helpful in preventing collisions, allowing the maximum amount of data to be received from every transmitter. This section will outline the steps to follow to select the best transmission intervals, and provide a worked example.

Using prime numbers is advantageous because the common multiples of two prime numbers are farther apart than the multiples of two nearby non-primes. (For example, the numbers 8 and 12 have a common multiple at 24, 48, 72, etc., while 7 and 11 have their first common multiple at 77.) So, if two transmitters were set up to transmit at 8 and 12 minutes respectively, a collision (and a lost transmission) would occur every 24 minutes, much more often than if they were set up to transmit at 7 and 11 minutes. When expanding to 3 or more transmitters, this property is even more pronounced.

The size of the prime number matters as well. For larger prime numbers, fewer collisions will occur in a given amount of time.

Finally, to minimize the impact of the collisions that do occur, the transmitter should be configured to transmit the same data at least twice for every reading. This can be accomplished using the "Return most recently recorded data only" option in the Wireless Configuration dialog. For two transmitter systems, this ensures that every reading will have at least one clear window for transmission. If two transmitters collide during the first transmission attempt, they cannot possibly collide during the second (they are scheduled to select different windows for the second attempt). For three or more transmitters, it is possible to collide with one transmitter on the first attempt and another on the second attempt, but the number of these "sequential collisions" is very small.

The general procedure for selecting transmission intervals follows below. It assumes that all the transmitters will be recording data at the same rate.

1. **Determine the number of transmitters** – Determine the number of points that need to be monitored, and select the transmitters that will cover those points most efficiently.

2. **Determine the reading interval** – The reading interval selected for the devices should be the longest interval that will provide the data needed for the application.

3. **Select the prime numbers** – The transmission intervals must always be a multiple of 10 seconds. So, divide the reading interval (in seconds) by 20, and pick the largest prime numbers that are less than this value. This ensures that there will always be at least two transmission slots per reading for each transmitter. Prime numbers in the necessary range are listed in Table 1 below.

4. Assign the transmission intervals – Multiply the prime numbers selected in step 3 by 10, and assign them to the transmitters. If some transmitters are monitoring more critical data than others, they may be assigned the smaller or larger numbers depending on the application. If the smallest numbers are substantially less than half the reading interval (e.g. 130 seconds for a 10 minute reading interval), assign them to the more critical transmitters to increase the number of transmissions per reading. If the smaller numbers are close to half the reading interval, assign the larger numbers to the critical transmitters, as the larger numbers will experience slightly fewer collisions.

5. Configure and launch the devices – In the Wireless Configuration dialog, enable the custom transmit interval, and select the **Return most recently recorded data only** option for each device. Enter the proper transmission interval in seconds (be careful not to enter the number incorrectly as hours/minutes/seconds), and save the configuration before exiting the dialog. When launching the devices, use delayed start mode to begin the transmission schedules at the same time, and select the reading interval determined in step 2.

Table: Prime numbers from 3 to 2160

--	3	5	7	11	13	17	19	23	29
31	37	41	43	47	53	59	61	67	71
73	79	83	89	97	101	103	107	109	113
127	131	137	139	149	151	157	163	167	173
179	181	191	193	197	199	211	223	227	229
233	239	241	251	257	263	269	271	277	281
283	293	307	311	313	317	331	337	347	349
353	359	367	373	379	383	389	397	401	409
419	421	431	433	439	443	449	457	461	463
467	479	487	491	499	503	509	521	523	541
547	557	563	569	571	577	587	593	599	601
607	613	617	619	631	641	643	647	653	659
661	673	677	683	691	701	709	719	727	733
739	743	751	757	761	769	773	787	797	809
811	821	823	827	829	839	853	857	859	863
877	881	883	887	907	911	919	929	937	941
947	953	967	971	977	983	991	997	1009	1013
1019	1021	1031	1033	1039	1049	1051	1061	1063	1069
1087	1091	1093	1097	1103	1109	1117	1123	1129	1151
1153	1163	1171	1181	1187	1193	1201	1213	1217	1223
1229	1231	1237	1249	1259	1277	1279	1283	1289	1291
1297	1301	1303	1307	1319	1321	1327	1361	1367	1373
1381	1399	1409	1423	1427	1429	1433	1439	1447	1451
1453	1459	1471	1481	1483	1487	1489	1493	1499	1511
1523	1531	1543	1549	1553	1559	1567	1571	1579	1583
1597	1601	1607	1609	1613	1619	1621	1627	1637	1657
1663	1667	1669	1693	1697	1699	1709	1721	1723	1733
1741	1747	1753	1759	1777	1783	1787	1789	1801	1811
1823	1831	1847	1861	1867	1871	1873	1877	1879	1889
1901	1907	1913	1931	1933	1949	1951	1973	1979	1987
1993	1997	1999	2003	2011	2017	2027	2029	2039	2053
2063	2069	2081	2083	2087	2089	2099	2111	2113	2129
2131	2137	2141	2143	2153	--	--	--	--	--

	Example 1	Example 2
Number of Transmitters	5	5
Reading Interval	10 minutes (600 seconds)	1 hour (3600 seconds)
Max Transmission Interval	300 seconds (= 600/2)	1800 seconds (= 3600/2)
Max Prime Number	30 (= 300/10)	180 (= 1800/10)
Selected Prime Numbers	29, 23, 19, 17, 13	179, 173, 167, 163, 157
Transmission Intervals	290 seconds 230 seconds 190 seconds* 170 seconds* 130 seconds*	1790 seconds* 1730 seconds* 1670 seconds 1630 seconds 1570 seconds
* More critical devices		
First Lost Reading After	> 2 hours	> 45 days

Prime Number Examples

Two examples are provided in "Table:Prime number examples" below to illustrate the procedure. Notice that increasing the reading interval by a factor of 6 (1 hour instead of 10 minutes) results in an increase by a factor of 540 in the time before data is lost (45 days instead of 2 hours)!

Table: Prime number examples

Wireless: Autosave of Wireless Data

A convenient feature of the Wireless Real Time Chart Recording mode of the MadgeTech software is the ability to automatically save the data to all supported data file formats such as (.CSV files); software version 2.00.70 or higher is required. Data can also be saved manually using **File**/**Save As** in the software or the **Save As** button in the **Configure Wireless Data** dialog.

Note. While the Auto Save feature is enabled, system memory consumption will go up. To avoid excessive PC memory consumption, MadgeTech recommends setting the amount of readings that are saved to the highest value (e.g. every 1000 Readings) that is possible. For operations with 1-2 data loggers, it is OK to set "200" as the reading count. To select where a file is automatically saved/archived to, simply click the **Browse** button and specify a directory where the files will be automatically saved. Note. Initially, the default directory is the same as that set in your software preferences under the **Data** tab. To setup the autosave feature, ensure your wireless data logger has been started by using a standard interface cable, and that the RFC101A wireless receiver is now attached to the target PC. Precisely, follow the steps:

1. Start the logger as in the section Starting the Device and Synchronizing the Transmitter

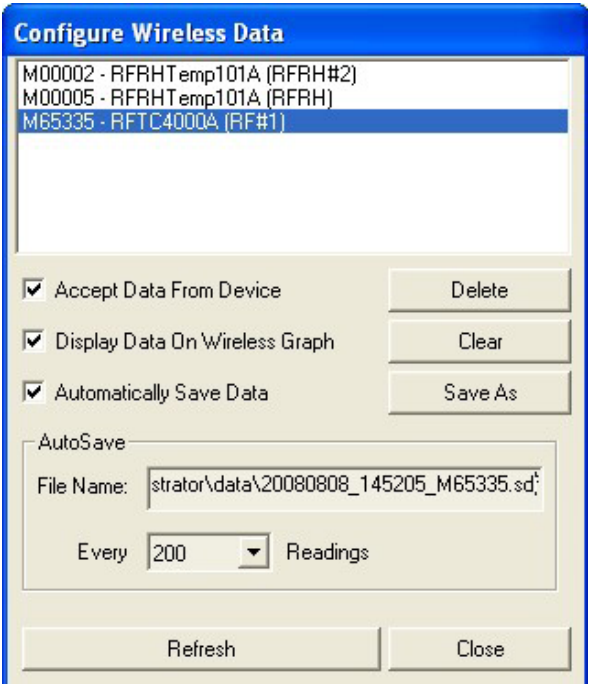
2. Under the **Communications** menu, ensure that **Accept Real Time Wireless Input** is checked.

3. Choose the **Composite Graph** tab to view all of the wireless data set.

4. Click **Device** Menu and note the following menu additions/changes pertaining to wireless transmissions:

- Configure Wireless Data
- Wireless Statistics
- Wireless Alarm Setup

5. Click **Device** menu then **Configure Wireless Data**. The Configure Wireless Data window below will appear and list the loggers whose wireless data have been received.



6. The following checkboxes are:

Accept Data From Device – allows the user to set whether the software accepts wireless data from each device in the list. This is useful if it is necessary to isolate data reception to certain transmitters in certain locations.

Display Data on Wireless Graph – allows the user to set whether the software displays wireless data from each device in the list. This is useful if it is desirable to only view data from certain devices.

Automatically Save Data – allows the user to set whether the software will automatically save data from each device in the list. This is useful if you want to archive data from some devices, but not all of them.

Browse button - allows the user to program the directory where saved data is archived.

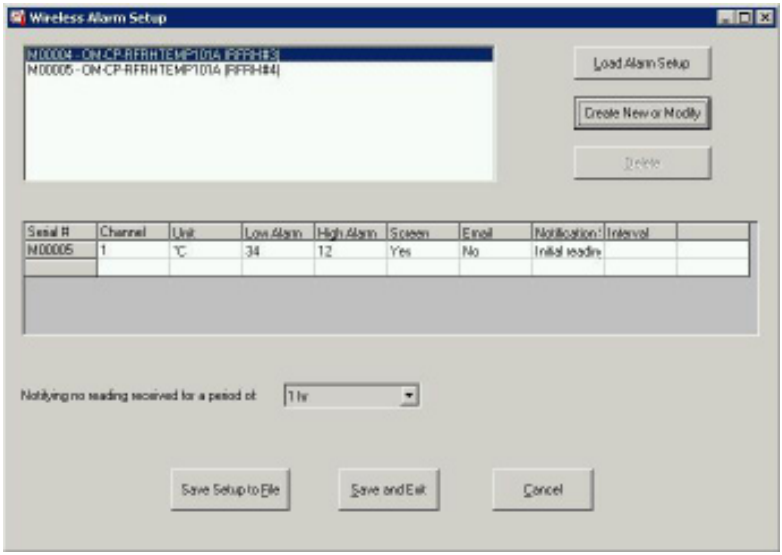
The **Readings** drop down menu - allows users to program the data to automatically save after a certain amount of data has been received.

7. Careful use of Autosave – It is recommended that Manual save be used in most cases. If Autosave of wireless data is needed for record keeping purposes, use a longer autosave interval as the number of received data loggers increases. Autosave interval is set as default at every 500 readings. When using 1-2 loggers, 200 reading interval will be OK; while when using 10 loggers, 1000 reading interval is recommended. Autosave feature will be improved when MadgeTech implements XML file format for autosave in the future release.

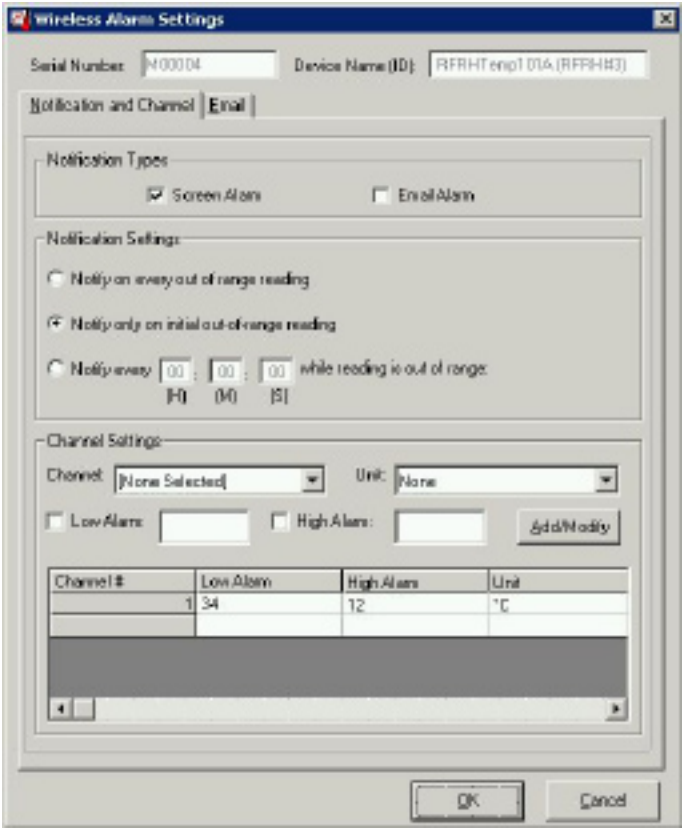
Wireless: Real Time Wireless Alarming

This feature is useful when alarm notifications (screen, email, cell phone text message) are critical. To set up real time wireless alarming, ensure the transmitter(s) in use have been started and the RFC101A receiver is installed on the system and has been configured properly (e.g. change baud rate to 4800). To access the real time wireless alarming functions, follow these steps:

1. Start the logger as in the section Starting the Device and Synchronizing the Transmitter
2. Ensure that **Display Real Time Wireless Data** from the **Device** menu is selected.
3. Choose the **Composite Graph** tab to view all of the wireless data set.
4. Click **Device** then **Wireless Alarm Setup**.
5. The **Wireless Alarm Setup** window below will appear and list the loggers whose wireless data have been received.



6. Highlight an RF data logger and click the button C**reate New or Modify**. A **Wireless Alarm Settings** window will appear. The **Serial Number** and **Device Name (ID)** will be listed.



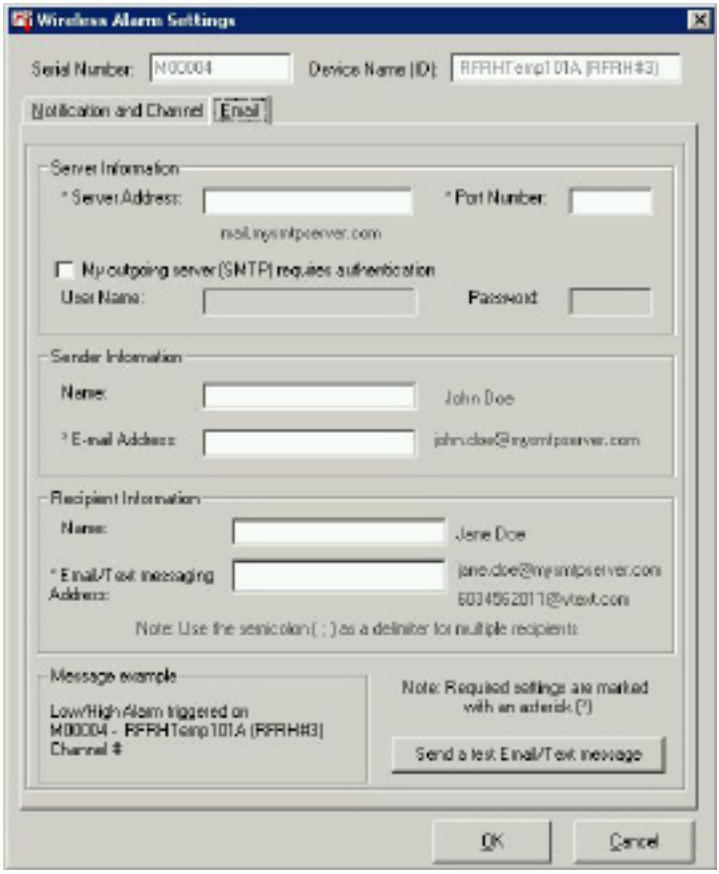
7. Ensure that **Notification and Channel** tab is selected. There are two notification types:

Screen Alarm – will notify the user with a window indicating an alarm has been activated.

Email Alarm – will notify the user with an email or cell phone text message that an alarm has been activated. If you check the **Email Alarm** checkbox then please remember to go to **Email** tab to enter the required information.

NOTE: For email notification, please contact your IT Department for information on your mail server/network settings. For cell phone text messaging, please contact your cell phone company to activate your cellular phone to receive emails in the form of text message alarms. The feature to mention to the cellular phone company's is "SMS messaging to email", or email to cellular text message function. In order to use the cellular phone text messaging option, this must be completed.

For convenience, MadgeTech is providing this web site for customers to look up the section titled "Email to SMS / Web to SMS":
http://en.wikipedia.org/wiki/SMS_gateways



Notify on every reading out of range – will notify the user at the programmed sample interval when an alarm condition has occurred.

Notify only on initial out of range reading – will notify the user as soon as the first alarm condition occurred, but will not continue to alert the user thereafter.

Notify on every [H] [M] [S] while reading is out of range – will notify the user after a specified length of time that an alarm condition has occurred. This is useful if a parameter is allowed to stay in an alarm condition for a certain amount of time, and if the alarm continues, it is of concern to be alerted.

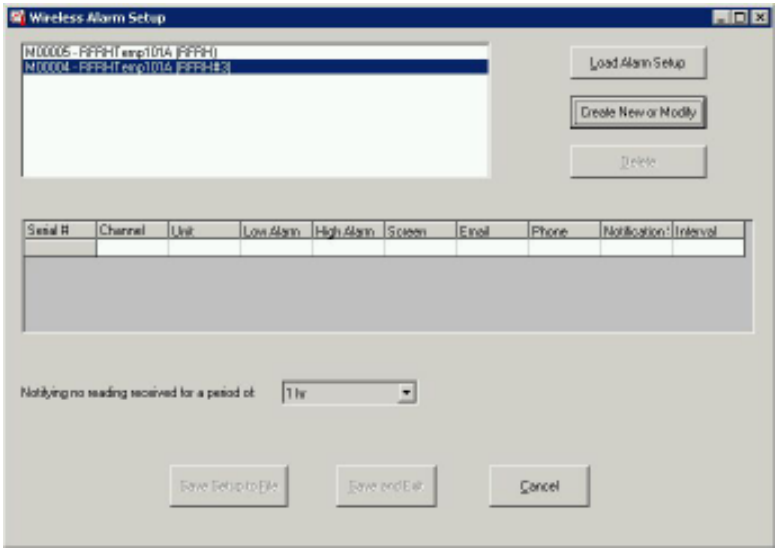
Channel Settings – Allows the user to set the channel in which they want an alarm to be associated with. The user can also specify the respective units for the measurement channel.

Low Alarm – allows the user to specify that if a value measured is lower than what the user specified, then either a screen and/or email/text message alarm will appear.

High Alarm - allows the user to specify that if a value measured is higher than what the user specified, then either a screen and/or email/text message alarm will appear.

Add/**Modify** – allows the user to add the created alarm to the alarm list. To save the alarm settings, click **OK** to save the settings and close the **Wireless Alarm Settings** window.

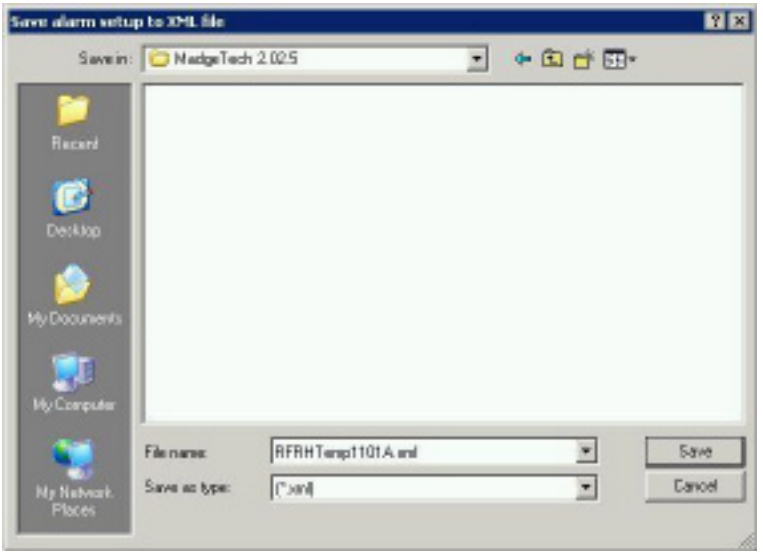
In the **Wireless Alarm Setup** window the data grid will show the added alarms. Click the **Save and Exit** button to save the settings and close the **Wireless Alarm Setup** window. If the user clicks the **Cancel** button, the window will close without saving settings/changes.



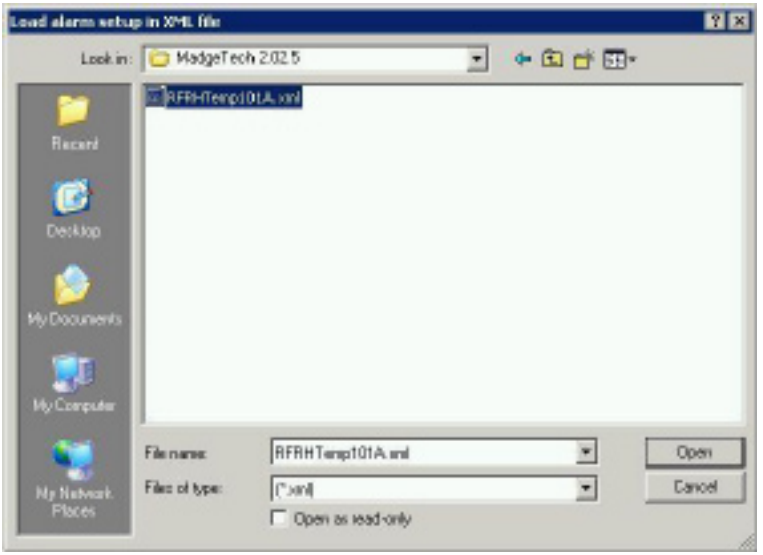
In the **Wireless Alarm Setup** window, highlight an alarm in the data grid and this will enable the **Delete** button. Use the **Delete** button to delete an alarm. Click the **Save and Exit** button to save the changes or click **Cancel** to ignore the changes.

In **Wireless Alarm Setup** window, if there are entries in the data grid, then the feature **Notifying no reading received for a period of TIME** will be enabled. This feature allows the user to be notified if no wireless data has been received for a period of TIME either in terms of Screen Alarm or Email Alarm (as checked in the **Wireless Alarm Settings** window).

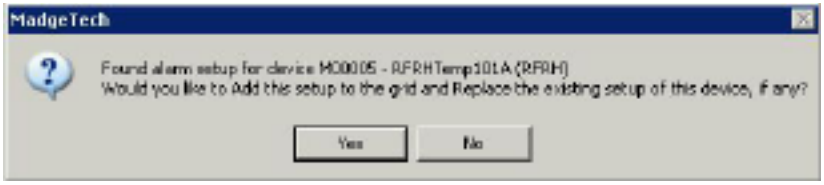
The **Save Setup to File** button will become enabled when there is one or more alarm set up and shown in the grid. Click **Save Setup to File** and enter a file name to save all the alarms in the grid to the XML file.



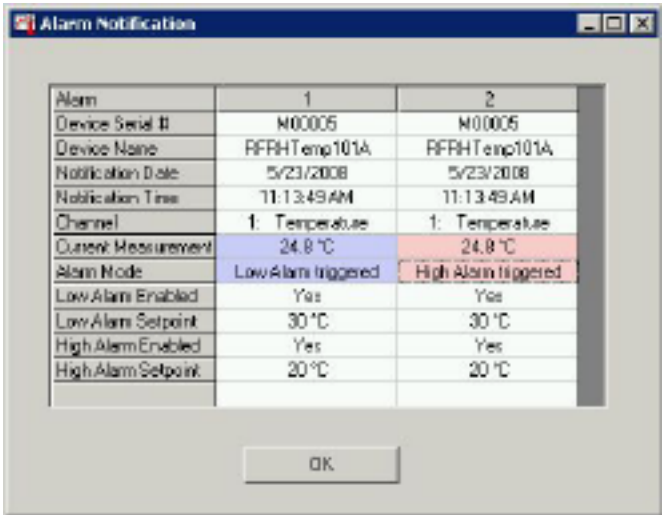
If the device to be set up for wireless alarming is listed then their previous saved alarm setup can be loaded. Click **Load Alarm Setup** button and select the XML file to load.



Click **OK** button. If this file contains alarm setup for the active devices shown on the list then a message will show up to confirm.


MadgeTech
Found alarm setup for device M00005 - RFRHTemp101A (RFRH)
Would you like to Add this setup to the grid and Replace the existing setup of this device, if any?
Yes
No

Wireless alarm notification will appear like below:


Alarm Notification
Alarm 1 2
Device Serial # M00005 M00005
Device Name RFRHTemp101A RFRHTemp101A
Notification Date 5/23/2008 5/23/2008
Notification Time 11:13:49 AM 11:13:49 AM
Channel 1: Temperature 1: Temperature
Current Measurement 24.8 °C 24.8 °C
Alarm Mode Low Alarm triggered High Alarm triggered
Low Alarm Enabled Yes Yes
Low Alarm Setpoint 30 °C 30 °C
High Alarm Enabled Yes Yes
High Alarm Setpoint 20 °C 20 °C
OK

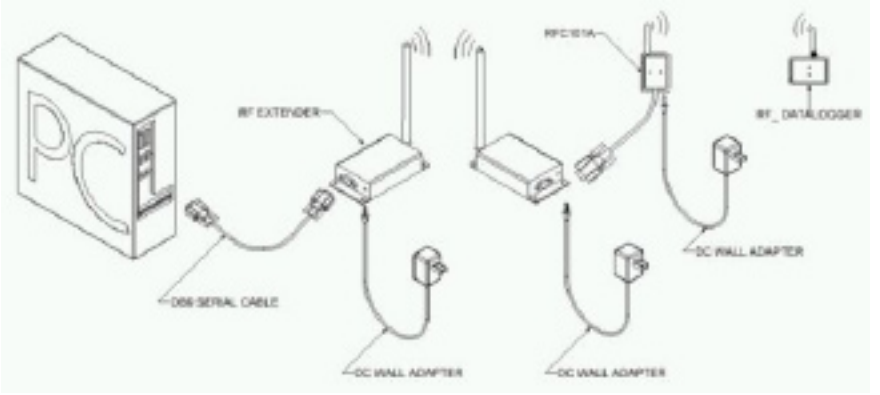
Wireless: Increasing Range with the RFExtender

The RFExtender products can extend the transmission distance of MadgeTech's RF series products for up to 1 mile (1.6 km) under ideal conditions. Typical ranges are 1000 to 2000 feet (300 to 600 m) outdoors, and up to 300 feet (100 m) indoors. An RFExtender system requires a minimum of two RFExtender transceivers, one at each node of the wireless link. The RFExtender transceivers require AC power.

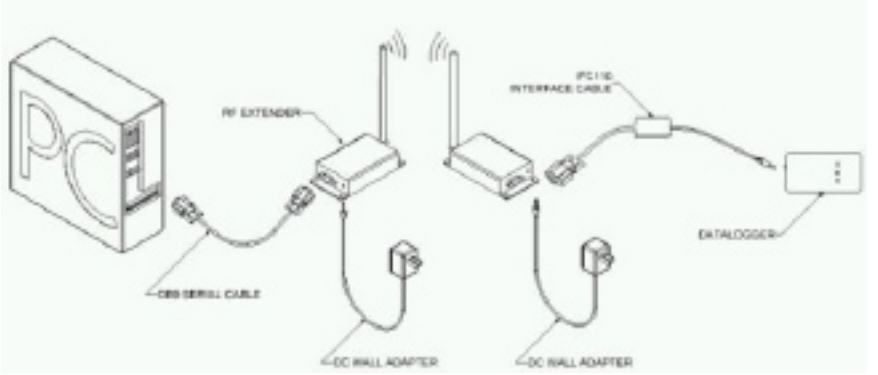
Simple RFExtender System

A basic set-up might be one of the two configurations below:

1. RFExtender as a wireless repeater



2. RFExtender as a wireless communication interface



In either configuration, the RFExtender functions like an extension cable between the logger interface and the PC. The primary difference between the two setups is the logger interface that is connected to the RFExtender. Figure (RFExtender as a wireless repeater) uses an RFC101A, and is therefore limited by the one-way communication between the RF data logger and the RFC101A. Just like using the RFC101A by itself, this setup requires that the logger be brought back to the PC and connected to an IFC110 interface cable to launch, download, or configure the logger. Figure (RFExtender as a wireless communication interface) allows two-way communication through the IFC110 and thus can allow full use of the data logger features.

The setup in Figure (RFExtender as a wireless repeater) is necessary when several transmitters must send their data to the same RFExtender. The data is received by the RFC101A, and retransmitted or "repeated" to the PC. Figure(RFExtender as a wireless communication interface) is appropriate when only one data logger needs to be used with a particular RFExtender, at a particular time. The data logger is configured to transmit data packets over the serial cable instead of through the wireless transmitter, and the RFExtender transmits the serial data back to the PC. This setup has two advantages: the logger can be launched, downloaded, and configured without bringing it back to the PC, and the IFC110 interface cable is less expensive than the RFC101A.

Complex RFExtender System

It is possible to use more than two RFExtenders in a system with more than two nodes. This type of setup will be an extension of the two simple setups demonstrated above. Refer to Figure(RFExtender as a wireless communication interface) for an example of a complex system.

The Figure on page 137 (A complex RFExtender system) shows an RFExtender connected to a PC that can receive data from 8 other transceivers. Each of the remote transceivers can either communicate serially with one logger via an IFC110 or receive wireless data from multiple RF series transmitters through an RFC101A. For this system to function properly, each transceiver must be set up to receive data only from the proper location. This is accomplished by assigning each transceiver a unique module address to identify itself, and a receiver address mask to identify the module addresses from which it will receive data.

Module Address and Receiver Address Mask

The module address provides a unique identification of the individual transceivers. It consists of 4 hexadecimal digits, which can be divided between a "system number" and a node address within that system. Most applications will us a module address of the format XXYY, where XX is the system number and YY is the node address. A system is comprised of a PC connected to an RFExtender transceiver (the "Local Node") and several other transceivers ("Remote Nodes") setup within the transmission range. Using the system number is not strictly necessary, but it allows several groups of transceivers to be located within transmission distance of each other without allowing data from one group to be received by the other.

The receiver address mask is also 4 digits and will usually be configured in one of two ways: to receive data from all the modules within a system, or to receive data only from another module with the same module address. Only the local node at the PC will be configured to receive data from multiple modules, as only the PC is capable of receiving and processing the data being transmitted by all the modules. The remote nodes will be assigned individual addresses, and configured only to accept transmissions from a module with the same address as their own. To allow two-way communication with a remote node, the local node module address and receiver address mask will be changed temporarily to match that of the remote node.

Assigning module addresses should begin with the determination of the system number. The system numbers used may be sequential, starting with one, as the zero address has special significance. The local node should be assigned node address zero, and the remote nodes may be sequential starting with one. Note that this is how the module addresses in Figure(A complex RFExtender system) below were generated.

The receiver address mask instructs the transceiver which data to receive by indicating what part of the incoming module address should be compared to its own module address. The remote nodes should be assigned receiver address masks of “FFFF”. In general terms, a hexadecimal digit “F” in the receiver address mask means “compare this digit”. So a receiver address mask of “FFFF” means “compare all the digits”, and if all the digits do not match, ignore the incoming data. In technical terms, the comparison is performed as a logical “AND” operation, which is a common function in computers and digital circuits.

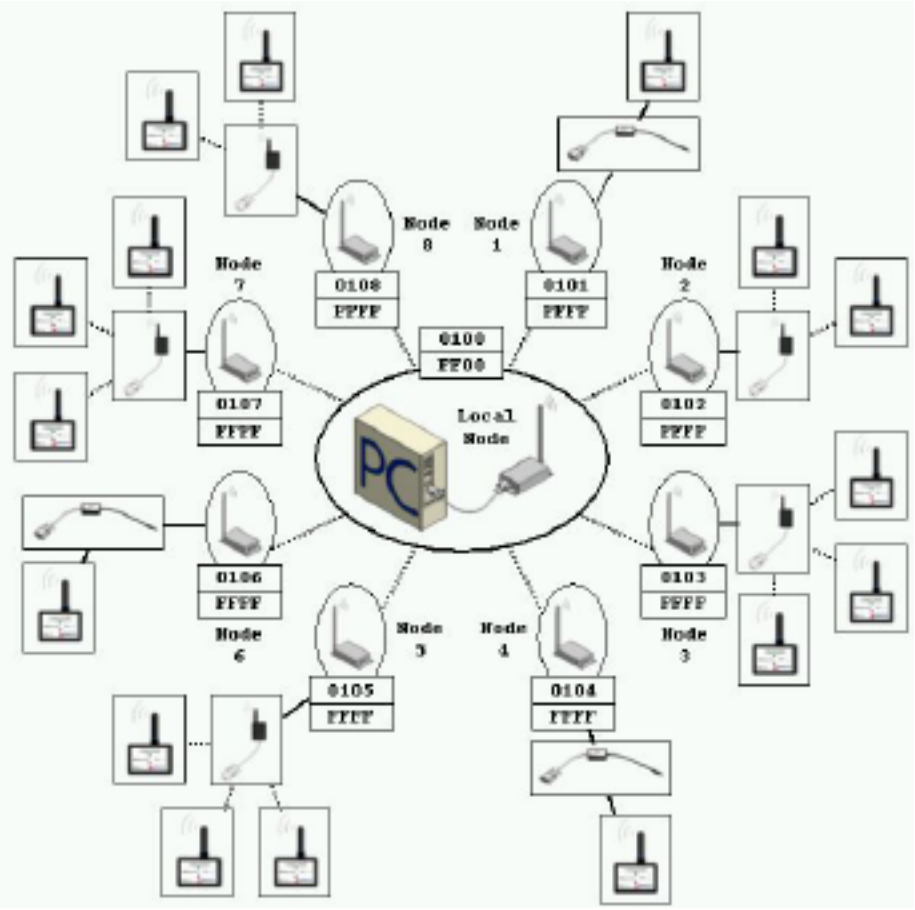
Receiver Address Mask Example

The local node in Figure (RFExtender as a wireless communication interface) has a module address of “0100” and a receiver address mask of “FF00”. Suppose that it receives data from module address “0104”. The incoming address is processed through the mask as “0104” AND “FF00” = “0100”. The result matches the local node address of “0100”, so the transceiver passes the data through.

Likewise, suppose that module address “0104” receives data from module address “0108”. The incoming address is processed through the mask as “0108” AND “FFFF” = “0108”. The result does not match the receiver’s module address of “0104”, so the receiver ignores the data.

For further information on uses of the module address and receiver address mask, contact MadgeTech Technical Support.

A complex RFExtender system



Wireless: Battery Life

There are many variables that affect the battery lifetime. These variables include (but are not limited to) sample rate, transmit rate, LED settings, transmission settings, ambient temperature and battery self-discharge.

For the purposes of approximating battery life, please consult Tables 3 and 4 below. These numbers should not be used as an absolute guarantee, but as an approximate guide for deciding when the battery will need replacement. This table is useful because the lithium batteries used in the RF products do not show a strong correlation between voltage and remaining capacity, which makes it very difficult to measure their remaining life. In lithium batteries, the voltage stays very nearly constant for the entire life of the battery until it drops sharply and suddenly when depleted.

There are variables that it is not possible to account for in the tables. The table assumes a pattern of continuous use, in which both the logger and transmitter features are used such that both the transmitter and logger are active at approximately the indicated "activity rate" (for cases where the logger and transmitter operate at different rates, use the faster rate for estimation). The calculations assume that the device is configured and deployed, then downloaded and redeployed when the logger is nearly full.

Table: Estimated battery life

ACTIVITY RATE	WORST CASE	FACTORY DEFAULT	BEST CASE
30 seconds	3 months	6 months	6 months
1 minute	6 months	12 months	12 months
2 minutes	12 months	20 months	24 months
3 minutes	15 months	27 months	3 years
4 minutes	21 months	33 months	3.5 years
5 minutes	24 months	3 years	4 years
6 minutes	27 months	3.5 years	5 years
8 minutes	33 months	4 years	6 years
10 minutes	3 years	4.5 years	7 years
15 minutes	4 years	5 years	8.5 years
30 minutes	5 years	6 years	10+ years
1 hour	6 years	6.5 years	10+ years
2 hours	6.5 years	7 years	10+ years
4 hours	7 years	7+ years	10+ years

The transmitter settings used to calculate the best, worst and factory default cases are indicated in Table:Transmitter settings for battery life estimation.

Table: Transmitter settings for battery life estimation

	WORST CASE	FACTORY DEFAULT	BEST CASE
Wireless Output	Enabled	Enabled	Enabled
Serial Output	Not Significant	Not Significant	Not Significant
Logging Option	Not Significant	Not Significant	Not Significant
Switch Option	Not Significant	Not Significant	Not Significant
Randomization	Enabled	Disabled	Disabled
Error Correction	Enabled	Disabled	Enabled
Custom Interval	Enabled	Disabled	Disabled
Sampling Option	Not Significant	Not Applicable	Not Applicable
Indicator Mode	10 seconds	10 seconds	Reading only

Even longer battery life can be achieved by disabling the wireless output in favor of serial-only or no transmission. Battery life is not calculated for these unusual cases.

Wireless: Operating Environment

The RF series data loggers are rated for –30 to +70 °C (-5 to +50 °C for the RFpHTemp101A) and up to 95 %RH (non-condensing). Although the devices are fully functional over this range, the strength of the wireless output signal may vary with changes in environment. In particular, the signal strength may be reduced at the temperature extremes, in high humidity, or if humidity condenses inside the device.

Wireless: System Performance and Reliability

To achieve maximum distance for the wireless transmission, there are a number of guidelines that should be followed. Consider these points when setting up the system:

Transmitter location - Keep the transmitter as close to the receiver as possible. If either the transmitter or receiver must be in an enclosed area, keep the other inside the same area. This is especially important if there would be metal walls, conduit, or wires between the units. In particular, attempting to transmit from inside of a freezer or refrigerator is not likely to be successful.

Line of sight - Keep the transmitting and receiving antennas along a direct line of sight from one to the other. In addition, keep the number of corners or obstacles in between them to a minimum.

Nearby objects - Try to keep the transmitting and receiving antennas away from any foreign objects, especially those made of metal. Performance may be improved by moving the antenna away from the ground, ceiling, or nearby objects.

Antenna orientation - Keeping the transmitting and receiving antennae parallel with one another may improve performance.

Composite Graph - Keep the Wireless Realtime Chart Recording selected on the Composite Graph tab when receiving readings from multiple recorders.

Minimize interference - Keep external sources of radio frequency noise to a minimum. Locate the antenna and receiver as far from any other electrical or wireless devices as possible. If multiple transmitters are being used, set up the system to minimize interference between transmitters.

Minimum delay between readings - Keep the transmit intervals to no less than 30 seconds between readings on ALL devices. This can be accomplished using the Delay Start method and specifying start times at least 30 seconds apart from each other, and a reading rate that will not result in overlapping transmissions.

Recommended Maximum number of transmitters per system - See **Table: Maximum Recommended transmitters per system** for recommendations based on reading rate used.

Careful use of Autosave - It is recommended that Manual save be used in most cases. If Autosave of wireless data is needed for record keeping purposes, use a longer autosave interval as the number of received data loggers increases. Autosave interval is set as default at every 200 readings. When using 1-3 loggers, 200 reading interval will be OK; while when using 10 loggers, 1000 reading interval is recommended. Autosave feature will be improved when MadgeTech implements XML file format for autosave in the future release.

Table: Maximum Recommended transmitters per system

DATA FREQUENCY	TRANSMITTERS	TIME SEPARATION
2 minutes	8	30 seconds
3 minutes	6	30 seconds
4 minutes	8	30 seconds
5 minutes	10	30 seconds
6 minutes	12	30 seconds
8 minutes	16	30 seconds
10 minutes	10	1 minute
15 minutes	15	1 minute
30 minutes	30	1 minute
1 hour	30	2 minutes
2 hours	40	3 minutes
4 hours	48	5 minutes
8 hours	60	8 minutes
12 hours	72	10 minutes

Computer Specifications and Maintenance - As with any software application, a newer model computer with a fast CPU and plenty of available memory is a key factor in achieving the best performance. A windows disk cleanup such as Disk Defragmenter and Scandisk will help improve system performance greatly. System reliability can also be improved using the **File** then **Save** command to archive wireless data every x amount of readings. For example, reliability will be increased if data is being archived every 200 readings, than if it was being archived ever 2000 readings.

Periodically Restart the MadgeTech Software - For long-term wireless reception of multiple RF-series data loggers, MadgeTech recommends that the data be manually saved and the software restarted as often as every few days, depending on how often new data is received. Memory usage of the MadgeTech2.exe program can be tracked in the Processes tab of the Windows Task Manager. When a wireless data logger is configured and launched at the target PC, a unique *.DVC (device file) is stored in the MadgeTech program directory. This *.DVC file contains information about the wireless transmitter, which can be loaded on to other PC's so those computers can accept real time wireless data. Of course it is necessary that the PC on which the DVC file was loaded is setup with an RFC101A receiver, the baud rate is 4800, **Accept Real Time Wireless Input** is selected from the **Communications** menu, and **Display Real Time Wireless Data** is selected from the **Device** menu.

Wireless: FCC Compliance and Requirements

MadgeTech's RF series products operate in an "unlicensed" operation band, meaning the end-user does not need to do anything special (such as obtain a license) to legally make use of the product. MadgeTech has performed all the required testing and certification to ensure that these products meet the requirements for unlicensed operation outlined in 47 CFR Part 15.231 of the FCC rules. However, the user must understand and adhere to the following notes and guidelines:

Any user changes or modifications that are not expressly approved by MadgeTech, Inc. may void the user's authority to operate the device per FCC code, section 15.231.

Wireless: Federal Communications Commission (FCC) Notice

The following FCC IDs are associated with the devices covered by this manual:

PRODUCT	FCC ID	TRADE NAME
RFTemp101A	RUVBOARDRF	MadgeTech, Inc.
RFRHTemp101A	RUVBOARDRF	MadgeTech, Inc.
RFTC4000A	RUVBOARDRF	MadgeTech, Inc.
RFRTDTemp101A	RUVBOARDRF	MadgeTech, Inc.
RFpHTemp101A	RUVRFPHTEMP	MadgeTech, Inc.
RFVolt101A	RUVBOARDRF	MadgeTech, Inc.
RFProcess101A	RUVBOARDRF	MadgeTech, Inc.
RFPulse101A	RUVBOARDRF	MadgeTech, Inc.

The following statement applies to all of the devices covered in this manual:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Wireless: Industry Canada (IC) Notice

The following IC identification numbers are associated with the devices covered by this manual. These certifications/registrant numbers are displayed on the labels of the products. Removal or defacement of these numbers will void the IC certification.

PRODUCT	IC #	TRADE NAME
RFTemp101A	4953A-BOARDRF	MadgeTech, Inc.
RFRHTemp101A	4953A-BOARDRF	MadgeTech, Inc.
RFTC4000A	4953A-BOARDRF	MadgeTech, Inc.
RFRTDTemp101A	4953A-BOARDRF	MadgeTech, Inc.
RFpHTemp101A	4953A-RFPHTEMP	MadgeTech, Inc.
RFVolt101A	4953A-BOARDRF	MadgeTech, Inc.
RFProcess1D1A	4953A-BOARDRF	MadgeTech, Inc.
RFPulse101A	4953A-BOARDRF	MadgeTech, Inc.

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